

EVALUATING THE EFFECT OF INSTITUTIONAL REFORMS ON ELECTRICITY ACCESS IN RURAL KENYA

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ABSTRACT

Purpose: The study sought to investigate the effect of institutional reforms in the electricity subsector on rural electrification.

Introduction: Access to electricity in rural areas is very important to the beneficiary households, the community and the economy at large. Indeed, one of the elements upon which the realization of Kenya's Vision 2030 is hinged on, is the access to electricity. Cognizant of this, the government of Kenya has over the years implemented various institutional reforms through regulatory agencies like Rural Electrification Authority, Energy and Petroleum Regulatory Authority and Kenya power to accelerate the adoption of electricity in rural areas.

Methodology: The study adopted a survey design with a sample size of 384 drawn from rural households in Kakamega, Uasin Gishu and Nyandarua counties. Data was collected using questionnaires and analysed by both descriptive and multiple logistic regression.

Findings: The study has established that subsidies and legal reforms have a positive effect on access to electricity in rural Kenya. In addition, less than 50% of Kenyans in rural areas have access to electricity and that the electrification rate differs from one county to the other. Furthermore, most rural households are not aware of the institutional reforms in the electricity sub-sector.

Recommendation: The study suggest that the government should maintain the current tariff and subsidy programmes and sensitize the rural population on the reforms in the electricity sub-sector to enhance rural electrification.

Keywords: *Access to electricity, institutional reforms, Logistic regression, Rural.*

INTRODUCTION

It is widely acknowledged that even though energy is not a basic human need, it is an essential input into provision of other primary human requirements such as food, water, warmth among others (Benard, 2012). Therefore, energy is very critical for sustainability of people's livelihoods. Lack of access to clean and cheap energy is seen as a fundamental dimension of poverty especially in developing world (International Energy Agency (IEA), 2017). Satisfaction of essential requirements and reduction of poverty cannot therefore be achieved without enhancing access to clean energy services.

Connecting rural households to electricity is expected to improve quality of life and enhance the growth of the rural residents on a range of socioeconomic fronts. For instance, as a replacement of kerosene-based lighting sources, electricity lights reduce indoor air pollution and carbon emissions which leads to decline in health risks associated with carbon emissions (African Development Bank (ADB), 2015). In addition, electricity allows school-going children to carry out their studies during evening hours. Furthermore, rural electrification enables establishment of business opportunities like barber shops, saloons, entertainment centres, and promotes business operations by keeping them open for many hours into the night (World Bank, 2008). Access to electricity contributes directly to the fight against poverty and hence improvement of living conditions of the

people (African Energy Policy Research Network (AFREPREN), 2005). This is achieved through clean lighting, clean cooking energy, and safe drinking water.

Energy is pivotal for economic and social development. While lack of access to energy services constitute a major obstacle to sustainable development, improved access of the poorer sections of the population to energy services contribute directly to poverty alleviation. Access to affordable and appropriate energy services must and should grow significantly in order to improve the standard of living of the world's growing population (Andreas et al., 2007). According to International Energy Agency (IEA) and World Bank's state of electricity access report, there remain 1.06 billion people globally without access to electricity, and about 3.06 billion people still use solid fuel and kerosene for cooking and heating (IEA & World Bank, 2017).

IEA and World Bank report of 2017 on electricity access estimates that around 92% of the rural population (370 million people) in Sub-Saharan Africa lacked access to electricity; 70% (690) in south Asia; 48% (60 million) in Latin America; 22% (30 million) in North Africa (IEA & World Bank, 2017). This is particularly crucial for African countries since research shows that electricity access and consumption cause economic growth implying that the economy depends on energy for survival and vice versa (Odhiambo, 2009). This calls for energy growth paradigm that focuses on expanding access to energy services through innovative models. Using clean energy efficiently and applying cost effective technologies and systems to all sectors of the economy within a capital constrained context remains a major challenge in Africa. This makes the availability of electricity energy an absolute pre-requisite to economic and social development in Africa.

Kenya's efforts towards rural electrification are stipulated in the government's sessional paper number 4 on Energy (2004). This paper laid the foundation for the formation of the Rural Electrification Authority (REA), which was charged with the responsibility of accelerating the pace of rural electrification in the county and ensuring that that affordable, cost effective and adequate quality of electricity is made available to rural areas on a sustainable basis. REA was created in 2007 under section 66 of the Energy Act of 2006 with the principal mandate of extending electricity supply to rural areas, managing the rural electrification fund, mobilizing resources for rural electrification and promoting development use of receivable energy (GOK, 2014).

Specific structural reforms in the energy sectors began in mid-1990 with the establishment of Electric Power Act of 1997. The aim of this Act was to unbundle power generation from transmission and distribution. The Act assigned Kenya Electricity Generating Company

(Kengen) the mandate of power generation, while the then Kenya Power and Lightning Company (KPLC) (now Kenya Power), took charge of power transmission and distribution. Subsequently, several independent private power generating companies found their way into power generation as a result of this law. Nevertheless, Kengen, a state-owned company is still the biggest power producer. The Act also led to enactment of Electricity Regulatory Board (ERB) with the mandate to set, review and carry out adjustment to consumer power tariffs, and to enhance competition (CUTS, 2009). This function is to ensure that consumers of electricity are protected against any form of exploitation and that they get quality services from power distributor.

In the year 2004, the government of Kenya committed itself to unbundle power transmission and distribution function of the KPLC which resulted into Sessional Paper No. 4 of 2004 on Energy. Government's efforts were materialized in 2008 when Kenya Electricity Transmission Company (KETRACO) was registered. KETRACO plans, designs, constructs, operates and maintains its own power transmission lines (KETRACO, 2013). However, KPLC still has their old transmission lines. Reforms in the energy sector reached its climax following the enactment of the Energy Act No. 12 of 2006, which combined all laws associated to energy including electricity regulations (Sen, 2010). In addition, this Act provided provisions for establishment of Energy Regulatory Commission (ERC) now called Energy and Petroleum Regulatory Authority (EPRA) as the only agency mandated to regulate both economic and technical aspects of electric power, renewable energy and petroleum sub-sectors.

In the energy Act, EPRA is supposed to ensure that there is level playing field in the electricity sector, and where consumers are protected, as well as participate in the reform process. EPRA regulates electricity generation, transmission and distribution. It also responsible for setting and reviewing tariffs, licencing, law enforcement, settlement of disputes and sanctions power purchase agreements. These responsibilities are very central to consumer interest and accessibility to power. The reforms have affected internal organizational dynamics leading to changes in pricing, planning systems, regulations, institutions and demand management strategies for achieving favorable economic outcomes.

The implementation of effective electricity reforms should enhance access to electricity to the population. Mwangi *et al.* (2014) links reforms to enhanced physical availability, affordability, efficiency and service quality. The expectations of regulatory reforms are that, the newly introduced regulatory mechanisms would provide more powerful incentives for the electricity

subsector to reduce costs and improve service quality in a cost-effective manner and efficient access to investment in regulated infrastructure services (Onyango *et al.*, 2009; Mwangi *et al.*, 2014).

Nevertheless, following decades of reforming the power sector, one would expect to see a significant decrease in the population not connected to the national grid. This is however not yet clear for Kenya (IEA, 2010; Onyango *et al.*, 2013; Mwangi *et al.*, 2014; and Lee *et al.*, 2016). Rural electrification in Kenya is below the SSA with national access of 32% compared to an average of 35% for SSA and only 19% access in rural areas compared to 25% for SSA (ADB, 2016). In this case, low electricity access is choking economic growth in the rural areas and holding back many communities' efforts to improve their livelihoods (WB, 2008). Studies notably by Lee *et al.*, (2016) show that there is a large gap between poverty levels and electrification rates in Kenya which points to significant suppressed demand. While only 50% of the rural population is below poverty line, 93% of them do not have access to electricity (Lee *et al.*, (2016).

In Kenya, literature is limited on the effects of institutional reforms in the electricity sub-sector on rural electrification. A few studies carried out have mainly focused on factors driving electricity connectivity and not how reforms affect connectivity. For instance, recent studies by Mwangi *et al.* (2014) and Lee *et al.* (2016), have all focused-on drivers of adoption of electricity in rural areas. Thus, we establish how Kenya's institutional reforms in the electricity sub-sector affects rural electrification focusing on Kakamega, Uasin Gishu and Nyandarua counties. Specifically, we look at subsidies, legal reforms and electrification fund. Next, we present methodology, findings of the study, conclusion and policy recommendations.

RESEARCH METHODOLOGY

We sought to evaluate the effects of institutional reforms such as changes in tariffs/taxes, subsidies, level and type of funding, presence and type of legal reforms on rural electrification. An increase in tax rates on electricity equipment (material), or revenues for firms directly involved in generation and distribution of electricity is likely to affect access to electricity negatively. Low levels of funding to REA, ERC for instance, low subsidies, and high tariff rates are expected to reduce electrification rates in rural areas. The kind of legal framework in the electricity sub-sector might also affect electrification rates. Therefore, poor institutional reforms are expected to have a negative impact rural electrification.

The current study adopted across-sectional research design with quantitative approach. Households in three counties, that is, Kakamega, Uasin Gishu and Nyandarua were targeted. Kakamega County is the second largest county after Nairobi in terms of population (KNBS, 2019). It borders counties; Siaya to the West, Vihiga to the South, Bungoma to the North and Nandi to the East. It occupies an area of 3050.3 km² with an altitude of between 1,240 and 2,000 metres above sea level (Institute of Economic Affairs, 2013). The county has a total population of 1,660,651 which comprises of 863,539 females and 797,112 males (Kenya Population, Housing and Census (KNBS, 2019). The county has 301,616 rural households (KPLC, 2016), 177 transformers (KPLC, 2016) and electrification rate of 5.6%. According to Integrated Household Budget Survey (KIHBS) of 2015/2016, the head count poverty in Kakamega county stands at 35.8 percent (672,000), slightly below the national rate of 36.1 percent (KNBS, 2018).

Uasin Gishu County has a total area of 3,345.2 km² and borders Trans Nzoia county to the North, Baringo county to the South East, Elgeyo Marakwet County to the East, Kakamega County to the North West, Bungoma to the West and Kericho County to the South. Kenya's census report (2019) indicate that, the county has a total population of 894,179 with male to female ratio of 1:1. This county is a highland plateau ranging between 1500m and 2700m above sea level. The head county poverty in Uasin Gishu stands at 41.0 percent or 465,000 residents are living below poverty line, and occupies position 23 in the county ranking. This county is the main hub of agricultural farming activities of commercial cultivation of maize and wheat on large scale. Other crops cultivated in this county are: beans, potatoes and peas for subsistence and commercial purposes. The county has a total population of 124,207 rural households, 92 transformers and electrification rate of 27.9%.

Nyandarua County borders Laikipia to the north and north east, Murang'a and Nyeri to the east, Nakuru to the west and south west, and Kiambu to the south. According to the National census statistics of 2019, Nyandarua County has a total population of 596,268 with 51% females and 49% males. According to KNBS (2019), Nyandarua County has a total population of 120,123 rural households. The county with 167 transformers has an electrification rate 10.5%. Kenya Integrated Household Budget Survey of 2015/2016 shows that Nyandarua county has 34.8 percent poverty rate by head count (465,000) (KNBS, 2018). This rate is also slightly below the national poverty rate of 36.1 percent. Nyandarua County is ranked at position 19, indicating that its residents are more resourced than Kakamega and Uasin Gishu.

The study sampled 384 house households through stratified approach. For one to participate in the study, he/she ought to have attained 18 years and above, be of sound mind and residing in the rural set-up. Data was collected through administration of household questionnaires and analysed using both descriptive and inferential statistics with the aid of Scientific Package for Social Sciences (SPSS) software version 21.

RESULTS AND DISCUSSIONS

Out of 384 questionnaires, 360 representing 93. % were filled and returned. This response rate was considered sufficient for data analyses and inferences. According to socioeconomic characteristics, there were slightly more female respondents (51.9%) than their male counterpart (48.1%). Concerning marital status, majority of the respondents, 251(69.7%) were married followed by 14.7% who were single. In addition, 10.6% were widowed while only 14(3.9%) of them had either separated or divorced. With regard to the age of the respondent, the study reports that the average age was 40 years with a standard deviation of 14. The age ranged between a minimum of 20 and a maximum of 90.

On education, the study reports that most respondents, 138(38.3) were in possession of primary level certificates as their highest level of education, followed by 126(35%) who had attained secondary level of education. In addition, 52(14.4%) of those polled hold tertiary level certificates and 37(10.3%) have not attended formal education. Finally, 7 (1.9%) of the respondents did not disclose their education levels. Concerning occupation, findings show that majority of the respondents, 35% are unemployed followed by the self-employed at 31.1%. In addition, these statistics indicate that 33(9.2%) of the respondents are in formal employment, 50 (13.9%) earn their livelihood through daily labor while the remaining 8.1% of the respondents undertake other economic activities. Access to electricity in the three counties stands at 39.4 percent while non-accessibility accounted for 60.6 percent of the respondents polled.

In addition, financing of the electricity access using loans accounted for 24. 4% while other sources of financing accounted for 1.7%. In terms of the county connectivity, Table 1 indicate that Uasin Gishu county has the highest percentage of rural population with access to electricity (65.82%) followed by Nyandarua at 49.3% %, and finally, Kakamega has the lowest at 25.84%.

Table 1

County wise Access to Electricity

County	Household connected to the nation grid (electricity)		Total
	No	Yes	
Kakamega	155 (74.16%)	54 (25.84%)	209
Uasin Gishu	27(34.18%)	52 (65.82%)	79
Nyandarua	36(50.70%)	35(49.3%)	71
Total	218 (60.56%)	142 (39.44%)	360

Source: Author (2020)

We examined various measures of institutional reforms such as taxes, subsidies, electrification funds, legal and regulations whose results are presented in this sub-section. To begin with, the study sought first to establish whether households knew of the existences of taxes charged on electricity. According to the findings, 37.9% of the respondents were indifferent about this, followed by 32.4% who indicated having no knowledge of electricity taxes. The results also show that only 26.8% of the participants were aware on government electrification subsidy programme.

On the question of whether the law adequately addresses electricity access in the rural areas, the study confirms that majority of the respondents, 44.6% are indifferent. In addition, 28.9% agreed while the remaining 26.5% disagreed to the statement. This imply that majority of the rural households are not sure of the laws put in place to aid rural electrification is adequate or not.

Similarly, the study has established that majority of the households, 43.9% are unaware of the Rural Electrification Fund (REF), followed by those who were indifferent about the fund at 31.3%. Those who indicated that they were aware of the fund accounted for 24.8% of the households interviewed. Concerning the effect of REA on access to electricity, majority of the households surveyed were indifferent on whether the creation of REA had improved access to electricity at 60.5%, followed by 26.7% of the participants who argued that establishment of REA has enhanced electrification.

Logistic Regression between institutional reforms and access to electricity

Access to electricity was regressed on institutional factors (subsidies, legal and electrification fund). We adopted Principal Component Analysis (PCA) to generate subsidies, legal reforms and electrification fund variables from Likert scale items. Table 2 presents model summary results with Cox & Snell R Square and Nagelkerke R Square which are pseudo for R-square and adjusted R-

square in OLS regression. These values indicate the independent variables predict the dependent variable by about 5%-a less predictive power.

Table 2

Model Summary on institutional reforms and access to electricity

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	463.956 ^a	.039	.052

Source: Author (2020)

The classification table 3 shows the cross-classifying of the outcome (dichotomous) variable whose values are obtained to estimated logistic probabilities. To derive a dichotomous variable, a cut-off point must be established and their after, each of the probabilities are compared with the cut-off point value. Findings show an overall percentage of the probabilities of 62.6% is greater than the cut of value of 0.5 or 50%. This indicates a high level of accuracy.

Table 3

Classification Table on institutional reforms and access to electricity

Observed		Predicted		Percentage Correct
		no	yes	
Access to electricity	No	193	22	89.8
	Yes	111	30	21.3
Overall Percentage				62.6

a. The cut value is .500

Source: Author (2020)

The final output contains the logistic regression results with estimated coefficients (see Table 4).

Table 4

Logistic regression coefficients (Variables in the Equation)

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Subsidies	.317	.113	7.833	1	.005	1.373
Legal reforms	.275	.113	5.990	1	.014	1.317
Energy fund	.002	.111	.000	1	.984	1.002
Constant	-.439	.111	15.663	1	.000	.645

Dependent variable: Access to electricity

Source: Author (2020)

Table 4 summarizes the effect of institutional reforms on access to electricity. Logistic regression results can be interpreted with reference to both p-values and odd ratios (Exp (B)). The estimated coefficients indicate a positive relation exists between institutional reforms and access to electricity. The p-values (Sig) indicate that subsidies and legal reforms are statistically significant. These imply that taxes and legal reforms, as part of institutional reforms have a positive effect on the access to electricity in rural Kenya. Nevertheless, the study fails to establish the significance of regulatory reforms. Brown et al. (2006) and Holmes (2003) have noted that the for the low-income groups, price of electricity is a major determinant of electricity access. In addition, KIPRA (2009) argues that reduction of value added tax (VAT) on electricity by 4 percent in the year 2007, increased the usage of electricity at the household level.

With regard to odd ratios, reforms on subsidies have a higher chance of affecting electricity connectivity in rural Kenya as indicated by the ratio 1.373. Specifically, these results imply that a unit adjustment on subsidies could lead to 1.373 times change in the electricity access. Similarly, legal reforms have a higher probability of affecting electricity connectivity in rural Kenya given the odd ratio of 1.317. Thus, subsidies and legal reforms are found to be significant predictors of access to electricity in rural Kenya.

These findings have been supported by various studies around the world. For instance, Zhang et al. (2008) reported that reforms in the institutional framework could leads to efficiency and hence higher productivity, higher capacity utilization and lower system losses. Reforming the electricity sub-sector in Kenya to incorporate the private sector in the production of power is a positive move towards electrifying the country. Pollitt (1997) lauded participation of the private sector in the provision of energy. Nevertheless, he argues that this should only happen in the presence of a regulator to safeguard the interest of the consumers and the sector at large. On the contrary, Boss

(2013) observes that allowing competition as opposed to stringent regulations in the industry bears more gains.

However, having a reform is one thing but, implementing it is another thing. Evidence show that various factors could impede proper implementation of policy reforms and hence, not achieving the purpose for which such policies were put into place (Kowsari, 2011). Economic and social factors such as capabilities, behavioral, cultural characteristics and preference are among the key factors.

CONCLUSION

Various conclusions are drawn from findings of the study. Firstly, there is low electrification in rural areas and secondly, there is unequal access to electricity in different parts of the country. Thirdly, households in the rural areas have limited understanding of the institutional reforms (taxes, subsidies and energy fund) in the Kenya's electricity sub-sector. In addition, electricity bills and connectivity charges influences access to electricity in rural areas. Furthermore, it can be concluded that reforms on subsidies and legal reforms within the electricity energy sub-sector have a positive effect of access to electricity in rural Kenya.

POLICY RECOMMENDATIONS

Therefore, the government should take a deliberate effort to educate the rural population on the institutional reforms in the electricity sub-sector. Sensitizing people on electricity taxes and subsidies and existence of energy funds could help to increase electrification in rural areas. In addition, the government should maintain the current subsidies or review taxes on electricity downward to encourage rural electrification.

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