EFFECT OF REGULATORY REFORMS IN THE ELECTRICITY ENERGY SUBSECTOR ON ACCESS TO ELECTRICITY IN RURAL KENYA

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Effect of Regulatory Reforms in the Electricity Energy Subsector on Access to Electricity in Rural Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my beloved Mother Lasoha Kwimba, for teaching us the value of education. To my children, Bola, Argwings, Albertina and Bernadine whose future promises a world of plenty.

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ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey Fuller
AFREPREN	African Energy Policy Research Network
ARDL	Autoregressive-Distributed Lag
BOO	Build Own Operate
CUTS	Consumer Unity & Trust Society
DCs	Developed Countries
ERC	Energy Regulatory Commission
EPRA	Energy and Petroleum Regulatory Authority
ESMAP	Energy Sector Management System Program
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GWh	Giga Watt Hour
HRT	High Reliability Theory
IEA	International Energy Agency
IE	Institutional Ethnography
IMF	International Monetary Fund
IPPs	Independent Power Producers
KENGEN	Kenya Electricity Generating Company

KETRACO	Kenya Electricity Transmission Company
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
KP	Kenya Power
KPLC	Kenya Power & Lighting Company
KWh	Kilowatt Hour
LDCs	Least Developed Countries
LCPDP	Least Cost Power Development Plan
LPG	Liquefied Petroleum Gas
MW	Mega Watt
NAT	Normal Accident Theory
NPM	New Public Management
OECD	Organization Economic Cooperation and Development
OLS	Ordinary Least Squares
PP	Phillips Peron
REA	Rural Electrification Authority
SSA	Sub Saharan Africa
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNDP	United Nations Development Programme

WB	World Bank
WEC	World Energy Council
WGI	World Governance Indicators

DEFINITION OF OPERATIONAL TERMS

Access to rural electrification	The state of rural households being connected to the national electricity grid (ADB, 2015). Households within 600-meter radius of power distribution points (existing functional transformers).
Alternative power sources	These are sources of power other than electricity. This includes solar energy, biofuels etc.
Economic growth	An increase in the volume of goods and services produced by an economy for a specified period, usually per year (Mbatia, 2011)
Electricity	This is the energy dissipated in an electrical or electronic circuit or device per unit of time (ERC, 2008). It is the flow of electrons through a conductor.
Policy	A principle of action implemented or suggested by a government, party, business or an individual (IEA, 2017).
Rural electrification	This is a government programme to ensure massive connectivity of households in rural areas to the national grid (IEA, 2012).
Regulation	Rules or directives issued by state agencies to guide how electric service is provided to the public/customers (in this case, rural electrification**)** **(**Shively et al, 2008).
Regulatory reform	These are changes which are aimed at improving regulatory quality, that is, reforming regulations that

	raise unnecessary obstacles to competition, innovation, while ensuring that regulation efficiently serves important social objectives (Newberry, 2004).
Tariff	Prices, rates, costs and all other charges including adjustments (ERC, 2008)
Household Head	This is the most responsible/respected member of the household who makes key decisions in household on a day-to-day basis and whose authority is honored by all members of the household

ABSTRACT

Rural residents' ability to access electricity is essential for their homes, the neighborhood, and the local economy. According to a 2023 World Bank the advantages of electricity for rural households include lighting, information access, a better learning environment for kids, and an improved business climate, which leads to job opportunities and, as a result, poverty reduction as well as economic development. Indeed, one of the elements that will determine whether Kenya's Vision 2030 is accomplished is access to energy. Aware of this, the Kenyan government has over the years implemented a number of regulatory reforms through regulatory bodies like the Energy and Petroleum Regulatory Authority (EPRA), and Kenya Power and Lighting Company (KPLC) and Rural Electrification and Renewable Energy Corporation (REREC) to hasten the adoption of electricity in rural areas. These reforms address laws, governance, subsidies and tariffs among other issues. This study looked at how these reforms affected rural electrification to help guide future policy. The fact that the effect of these reforms has not received as much attention as it should have in the few studies that have been undertaken in Kenya is what inspired the study. In particular, the study looked at the effect of institutional reforms, governance reforms, service delivery reforms, on access to electricity in rural Kenya. The study's survey design included a target population of 545,946 rural households from the counties of Kakamega (301,616), Uasin Gishu (124,207), and Nyandarua (120,123). Using the multi-stage cluster sampling method, 384 of these households were selected as the sample size. Important sources from civil society organizations and regulatory bodies were also interviewed, including the KPLC, EPRA and REREC. Primary data was collected using surveys and key informant interviewing techniques, and then it was analyzed using multiple logistic regressions and descriptive statistics. The study's survey received a response rate of 93.75%. Through the use of both descriptive and logistic regression, the study revealed that subsidies, and legal reforms have a positive effect on rural Kenyans' access to electricity. The study also identified a positive relationship between governance improvements and energy access. The majority of rural families, according to the study, are not aware of the changes in the electricity sub-sector, and rural households only take part in a limited way in service delivery changes (Umeme Pamoja, Stima loans) that are meant to enhance rural electrification. It has been established that alternative energy sources have a negative effect on access to grid electrification of rural areas. The survey also revealed that the present rate of rural electrification in the selected counties is 39.4%. To promote rural electrification, this thesis recommends that the government educate the rural population about the reforms being implemented in the electricity sub-sector in light of the findings. The study also recommends that rural households should sensitized on the importance of participation in the sub-sector's governance processes to improve the reform outcomes. The study also recommends that the government keep the electricity sector's subsidy rates as they are so as to maintain the electricity accessibility momentum in rural areas. Accountability and decentralization should also be deepened in the electricity energy sub-sector.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Although energy is not considered to be a fundamental human need, it is commonly understood that it is a crucial component in supplying other fundamental needs of humans, like food, water, and warmth (World Bank 2023). The Kenya Vision 2030 identifies energy as an enabler in achieving the economic, social, and political pillars of the vision (GoK, 2014). As a result, energy is essential for the sustainability of human livelihoods. One major aspect of poverty, especially in developing countries, is the lack of access to affordable, clean energy (International Energy Agency (IEA), 2017). Therefore, improving access to clean energy services is necessary if essential needs are to be satisfied and poverty is to be decreased (World Bank, 2023). Access to energy is therefore extremely important in sustaining people's lives. According to Dalla et al (2021), Access to electricity that is affordable, reliable, and clean is a major goal of sustainable development. Under the Sustainable Development Goals (SDGs), access to electricity is not only concerned with providing affordable service to all persons but also delivering it in a manner that observes environmental and climate change principles (Oxfam, 2024).

Access to electrical energy is a critical factor to a country's socio-economic development as well as human socio-economic well-being. Electricity in rural homes is anticipated to improve living conditions and foster the development of rural communities on a number of socioeconomic fronts. For instance, electricity lights reduce indoor air pollution and carbon emissions by replacing kerosene-based lighting sources, which lowers the health hazards connected with carbon emissions (African Development Bank (ADB), 2015). Additionally, electricity enables students to complete their homework after-hours. Furthermore, by enabling the creation of businesses like barbershops, saloons, and entertainment venues, rural electrification encourages commercial operations by allowing them to remain open late into the night (World Bank, 2023). The ability to get electricity directly aids in the fight against

poverty and improving people's living situations (Mwangi, et al 2023). In-spite of this, globally the proportion of households without electricity is still high particularly in Sub Saharan Africa and in particular in the rural areas

Electricity improves the delivery of social services by enabling dependable heating, the refrigeration of vaccines and other medications, the sanitation of medical equipment, and the provision of illumination in educational buildings that allow for longer study time. This provides sufficient time for study and hence increased employability potential. Electricity access can also provide solutions to poverty indirectly through productivity enhancement which aids in income generation via the development of agriculture (irrigation and storage) as well as powering small-scale rural industry. Furthermore, to increase access to safe drinking water, the provision of clean energy such as electricity for pumping and boiling water is inevitable (Mwangi, et al 2023). The World Bank (2008) states that electricity improves business, creating jobs in addition to illumination, which enhances the study environment for pupils. Electricity is essential for the operation of appliances such as computers, televisions, radios, and mobile phones, which are important in relaying information to rural households. In financial terms, electricity replaces expensive traditional fuels such as kerosene and firewood. Therefore, access to electricity and rural poverty are closely correlated (Asentawa, et al 2022).

Energy is essential for the advancement of society and the economy (Godinho, 2019). The poorer segments of the population's better access to energy services directly contribute to the reduction of poverty, even though lack of access to energy services is a significant barrier to sustainable development. In order to raise the standard of life for the world's expanding population, access to inexpensive and suitable energy services must and should increase dramatically (Foster et al.2020). In the world, 733 million people still lack access to electricity, while 3.06 billion people still use solid fuel and kerosene for cooking and heating, according to the World Bank's state of electricity access report (World Bank, 2022).

The majority of the population without access to electricity is concentrated in Sub-Saharan Africa (see Figure 1.1). According to the World Bank energy progress report,

600 million people in Sub-Saharan Africa's rural areas lacked access to power, or around 65% of the population; South Asia accounts for 5% (133 million), Latin America for 2% (17 million), and North Africa for 1% (3 million) (World Bank, 2022). To improve the living standards of the growing world population, access to electricity can and should be increased (UNESCO, 2023). This is especially important for African nations because research indicates that having access to and using electricity promotes economic growth, indicating that the economy depends on energy for survival and vice versa (Stern, Burke& Bruns, 2019). This necessitates an energy growth paradigm that emphasizes broadening access to energy services using creative business models (World Bank, 2018). Using renewable energy effectively and implementing affordable technologies and systems across the board in an environment with little capital is still a significant problem for Africa. Because of this, the availability of electricity energy is a crucial prerequisite for Africa's economic and social progress (Mwangi et al. 2023).

Uneven access to electricity within continents and regions, within countries, and zones and areas in each country are partly responsible for uneven economic development (World Energy Council (WEC, 2024; World Bank, 2023). The Organization for Economic Co-operation and Development (OECD) and transition economies have nearly reached universal connectivity rates (IEA, 2024). The connectivity levels for North Africa are 99%, Latin America 98%, East Asia and the Pacific 95%, and the Middle East 89%, whereas the levels of electrification for South Asia and Sub-Saharan Africa are 80% and 35%, respectively.

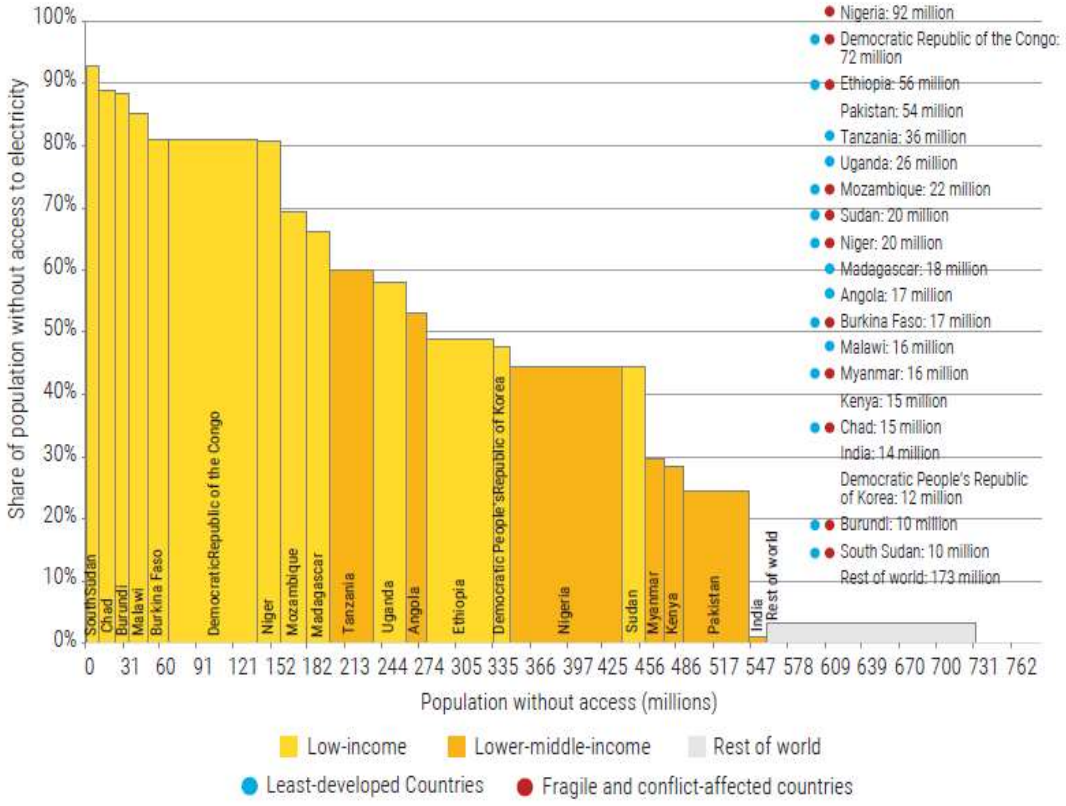

Figure 1.1: Top 20 Countries for Access Deficit in Electricity

Source: World Bank (2022)

Figure 1.1 indicates that Nigeria has the World's largest electricity access deficit followed by the Democratic Republic of Congo, and Ethiopia, while Kenya takes the 15th position.

1.1.1 Power Sector Reforms in Kenya

Power sector reforms were initiated in Kenya to respond to internal and external factors (Foster et al. 2023; Mwangi et al 2023). Internally, the power utility firms in Kenya were gripped by inefficiencies, wastage, and lethargy. While the electricity demand was growing fast, the requisite investment in the sector was not responsive (IEA 2022). The country was at the same time facing dwindling donor support and therefore desired to reduce the fiscal drain on the public-sector purse (Karekezi et al, 2009). Similarly, there was a need to improve the efficiency and quality of the services which has a link with attracting investments (Kirimania-Obura, 2005). On the external

front, there was a broad shift from state ownership and state regulation to market-based structures (Godinho et al, 2019). It was therefore necessary to implement policy and regulatory reforms. These reforms included unbundling of power generation from transmission and distribution, facilitation of the entrance of private power-generating firms to enhance efficiency in power delivery, encouragement, the establishment of the power regulator, and provision of a framework to integrate consumer's interest in the power reforms process (Zhang, 2012).

The foundation of reforms associated with competition started in 1989 with the establishment of the Restrictive Trade Practices Act of 1989. This Act purposed to enhance competition and to reduce price controls in the economy (Consumer Unity & Trust Society (CUTS), 2009). The latest legislation is the Competition Act of (2014) whose aim is to oversee fair pricing practices in all sectors of the economy. This law gave rise to the Competition Authority of Kenya (CAK), an organization responsible for protecting consumers against unfair trade practices. CAK receives and investigates complaints from consumers, and also disseminates guidelines to consumers related to its responsibility, to protect their interests.

In the middle of the 1990s, the Electric Power Act of 1997 was introduced by the government, signaling the start of specific structural and regulatory reforms in the energy sectors. The purpose of this Act was to separate power generating from transmission and distribution (CUTS, 2009). According to the Act, power generation was to be undertaken by Kenya Electricity generation Company (KENGEN), and power transmission and distribution were granted to the old Kenya Power and Lighting Company (KPLC), currently known as Kenya Power (KP). This regulation eventually led to the entry of numerous independent private power generation companies. However, the biggest generator of electricity is still the state-owned company, KENGEN. The Energy Regulatory Board (ERB), which was assigned the duty to determine, review, and implement changes to consumer power pricing as well as to foster competition, was also established as a result of the Act (CUTS, 2009). This role was to make sure that electricity users are shielded from abuse of any kind and receive high-quality services from power distributors. However, there is no empirical evidence that regulatory reforms have improved the electricity sub-sector's performance, in

terms of the protection of consumers' and investors' interests, and achievement of the government's policy objectives such as enhanced electricity access in rural areas.

Sessional Paper No. 4 of 2004 on Energy was written as a result of the Kenya government's commitment to split the KPLC's power transmission and distribution activities. The government's reform initiatives were escalated in 2008 with the registration of the Kenya Electricity Transmission Company (KETRACO). Power transmission lines are now planned, designed, built, operated, and maintained by KETRACO on a self-sufficient basis (GoK, 2013). Old transmission lines are still in use by KPLC, nevertheless.

The apex of the energy sector reforms was the enactment of the Energy Act No. 12 of 2006, which integrated all energy-related legislation, including the laws governing electricity (Mwangi et al. 2023). The Energy Regulatory Commission (ERC), was mandated by this Act as the sole entity in charge of regulating the technical and financial aspects of the petroleum, renewable energy, and electric power sub-sectors. According to this law, ERC was required to take part in the reform process to ensure that there are fair playing conditions in the electricity industry and to protect customers. The ERC (now called EPRA), controls the production, transmission, and distribution of power. It also oversees the creation and review of power purchase agreement tariffs, licensing, law enforcement, dispute settlement, and sanctions. The interests of consumers and their ability to exercise power are significantly influenced by these commitments. The reforms had an effect on internal organizational dynamics as well as pricing, planning systems, norms, institutions, and strategies for managing energy demand (Godinho et al, 2019; KIPPRA, 2022). The Energy Act 2019, which created the Energy & Petroleum Regulatory Authority (EPRA) as ERC's successor, marked the latest energy reforms. This Act defined the authorities and duties of the various energy sector bodies such as EPRA, REREC, and KPLC. The Act also, provided for national and local government energy functions and consolidated all legislation on the energy sector (GoK.2019)

These reforms also brought changes in the governance of the electricity sub-sector. For instance, decision-making associated with tariffs, pricing, and regulation was decentralized from the Ministry of Energy to EPRA, with the main purpose of ensuring better service delivery. However, it is still unclear, how these measures would affect rural Kenyans' access to electricity.

1.1.2 Electricity Transmission and Distribution in Kenya

The distribution and transmission of electricity in Kenya are handled by two companies. The Kenya Electricity Transmission Company (KETRACO) is responsible for the design, building, operation, and maintenance of high-voltage transmission lines. The second is Kenya Power (KP), which is in charge of buying power in bulk from Independent Power Producers (IPPs) and Kenya Power Generating Company (KENGEN) and distributing it to both business and residential consumers. In 2010, Kenya Power projected connecting 150,000 consumers to the national grid annually (KP, 2012). However, this has remained largely unachieved due to a variety of factors including, high upfront expenses, high connection costs, low demand, and low population density, which makes it expensive to begin with (KIPPRA, 2022).

Increased connectivity expenses, which vary depending on how far a family is from the transformer, have made it difficult for KP to serve an expanding client base, particularly in rural areas. While transformers are allocated based on government criteria (availability of funds and fair allocation of resources), the decision to connect to electricity lies with the individual household. Customers living within a 600m radius of a transformer, currently pay Kshs. 15,000. However, connection charges for those customers beyond 600m of a transformer, depend on the cost of material used, labour, and transport which is not within the reach of many potential rural customers. KP came up with several service delivery schemes to make their products more affordable. In one such initiative, KP initiated a partnership with Equity Bank to provide “Stima” loans (Electricity loans) for connection charges to potential customers living within 600m of the transformer. In this scheme, customers are required to pay 30% of the cost upfront, with the remaining amount payable over three years with a 15% annual interest rate.

The second program is for those customers living beyond the 600m radius of the transformer. The company offers a cooperative program known as “Umeme Pamoja” (Electricity Together). This program aimed to enable potential customers who normally would not have been afforded individual connection, except at a high cost, to finance the transformer charges and low-voltage charges. In the Umeme Pamoja program, the cost of connecting power to those households is divided equally among the affected customers, making it generally affordable. The third program administered by KPLC is a revolving fund that is open to all customers. In this program, a customer is required to pay 20% of connection charges upfront and clear the balance in two years. An administration charge of 2% is charged on the remaining balance of 80%. It is not yet clear how all these reforms and incentive schemes affect rural electrification.

1.1.3 Rural Electrification in Kenya

The rural electrification effort in Kenya began in 1973. However, many areas of the nation still lack access to power, despite these efforts. The overall connectivity rate in rural areas was 4% in 2003, which was 30 years after the program's beginning (Mwangi, 2014). The Rural Electrification Authority (REA) was founded in accordance with section 66 of the Energy Act 2006 (No. 12 of 2006) to spearhead rural electrification in Kenya. The goal of REA, a single independent authority, is to hasten the electrification of rural areas (REA, 2016).

The government's attempts to improve access to electricity in rural areas are described in sessional paper number 4 on Energy (2004). This paper aims to promote access to quality and affordable energy services while conserving the environment (GoK, 2004). The Rural Electrification Authority (REA), which is tasked with accelerating the pace of rural electrification in the country, was founded based on this sessional paper. REA is mandated to ensure that rural areas have access to affordable, efficient, and adequate quality electricity on a long-term basis. A Rural Electrification Plan was therefore developed. It is updated annually and has three phases: 2008-2012,2013-2022 and 2022-2030. The goal is to have 100 percent connectivity by 2030. The main objectives of REA, which was established in 2007 under section 66 of the Energy Act of 2006,

are to promote the use of renewable energy sources, manage the fund for rural electrification, and mobilize funding for rural electrification (GOK, 2014). To expedite the process, a 5% levy is imposed on electricity consumption, and the proceeds are used to fund rural electrification (Mwangi et al 2023). The name and mandate of REA have been changed to Rural Electrification and Renewable Energy Corporation (REREC) as a result of the repeal of the Energy Act of 2006 by the new Energy Act (2019).

Despite these reforms, Kenya's rural areas continue to have limited access to electricity and connectivity. The target of 100% access to electricity remains far from being achieved. Nevertheless, the reasons for the low uptake of electricity in rural Kenya are unclear. Some authors notably Mwangi et al (2023) have attributed the low connectivity to the national grid to poor service implementation strategies, institutional weaknesses, limited financing, weak implementing capacity; difficulties, and delays in obtaining way leave consents and rights of way. The Government has integrated off-grid interventions as an integral part of energy service delivery and embarked on an ambitious program in the underserved counties to reach all Kenyans (GoK, 2018). Abdullah (2007) also identifies socioeconomic factors such as access to income, political factors, and access to alternative power sources of power as limitations to rural grid electrification. For instance, Scott and Prachi (2013) argued that the relationship between politicians and the electorates can undermine the efficiency and effectiveness of public service delivery and skew resource allocation. Political leaders may for example extend the grid or offer protection from load shedding to get the support of certain groups and hence divert resources for rent seeking. In countries with democratic political systems and institutions, the balance of electricity services is towards residential use, while in authoritative systems, industries get a greater share of electricity (Brown and Mobarak, 2009). However, there is limited literature on political factors and how they affect access to electricity, particularly in Kenya. Dispersed low-income consumers and low demand for electricity in rural areas have led to a lack of interest among private electricity supply companies to service such areas. According to Abdullah et al (2007), high connection costs have depressed the

willingness to pay (WTP) among potential customers which can only be dealt with by the government through further reforms related to the provision of subsidies.

The overall rural electrification rate in Kenya is 65% (see Table 1.1) which is much higher than the sub-Saharan level of 35% (World Bank, 2023). According to international standards, countries with electrification rates of below 40% are said to be lowly electrified while those with electrification rates of above 70% are highly electrified (World Bank, 2015). This therefore means that with a 94% urban and national electrification rate of 75%, Kenya is ranked among the highly electrified countries (World Bank 2023). However, the huge gap between urban and rural electrification rates could be explained by poverty which makes an extension of the grid to rural areas uneconomical (KIPPRA, 2022). Competition from alternative energy sources which tend to be cheaper notably wood fuel (which provides 70% of energy needs) and solar energy which is advocated by some civil society groups have also lowered the willingness to pay (WTP) for electricity (Mwangi et al 2023; Oxfam, 2024). Although electrification rates in rural areas in Kenya have increased over time, they compare poorly to other African countries by comparable economic strength (Godinho, 2019).

Regarding regulation, advocates of change contend that independent regulation of the power sector promotes openness, citizen involvement, and equitable benefits for all stakeholders. Reforms also give decision-makers the chance to alter institutional structures that over the past sixty years have prevented expanded access to electricity in rural areas. According to Godinho et al (2019), REREC's capacity to combine rural electrification (RE) with end-user demand-enhancing elements including agricultural extension services, business development, and social services is inadequate. Energy sector reformers acknowledge the need for establishing specialized RE authorities because planning for energy in rural areas necessitates a more comprehensive approach. Haanyika (2008) stated that in a situation where the government might transfer the money to other priority programs, RE authorities would be more prudent in the administration of RE resources as it would be simpler to "ring-fence" RE finances. This would prevent government diversion of RE resources to other priority programs.

Table 1.1: National, Urban, and Rural Electrification Rates (%) in Kenya

Year	National	Urban	Rural
1993	8.4	13.0	1.7
1994	8.8	14.6	1.9
1995	9.0	14.5	2.0
1996	9.5	14.8	2.0
1997	9.9	15.0	2.6
1998	10.3	15.0	2.6
1999	10.5	15.8	2.5
2000	10.6	16.0	2.7
2001	11.0	18.9	2.9
2002	11.2	18.8	3.0
2003	12.8	19.0	3.0
2004	13.1	19.0	4.5
2005	13.4	20.2	4.7
2006	13.7	22.0	5.0
2007	14.0	22.0	5.0
2008	14.7	28.0	5.0
2009	16.1	36.0	6.0
2010	20.0	42.0	6.2
2011	23.0	50.0	6.7
2012	23.0	51.2	6.7
2013	23.0	54.0	11.8
2014	28.0	58.0	14.2
2015	30.0	58.2	19.2
2016	32.2	60.2	19.5
2017	55.6	67.1	29.5
2018	61.3	77.8	35.2
2019	69.7	84.1	45.1
2020	75.1	90.1	63.0
2021	75.5	92.0	64.3
2022	75.0	94.1	65.2

Source: Economic Survey (various issues)

The electrification rates in Table 1.1 indicate the trend in Kenya’s electrification rates for both urban and rural areas from 1993 to 2020.

The electrification rate refers to the percentage of households in a community that has access to electricity. Table 1.1 displays the trend in Kenya's electrification rates across the country as well as in urban and rural areas. Between 1994 and 2000, the rates of electrification in urban areas remained largely stable. There was a slight increase in the urban electrification rates between the year 2000-2001 and from 2002 to 2004,

urban electrification rates were relatively constant. These statistics further indicate that there was a sharp increase in the urban electrification rates between 2007-2011. This could have been occasioned by major reforms in the electricity sub-sector occasioned by the enactment of Energy Act No. 12 of 2006 which led to the establishment of EPRA to facilitate accountability, transparency, and participation in the sector. Even though there was an increase in urban electrification rates between 2012 and 2016, these increases have been slow compared to 2007-2011. The reason for this could be that most of the urban residents (domestic as well as commercial) had access to electricity hence the almost constant trend in electrification rates. On the other hand, rural areas recorded nearly constant growth in electrification between 1993 and 2003. Accordingly, the electrification rates started to show a steady increase from 2004 up to 2012. There was a sharp increase in urban electrification rates between 2012 and 2018. The implication of this could be that the reforms and the KP incentive programmes in the electricity sub-sector played a role in this shift. However, there remains a gap in understanding the extent to which regulatory reform outcomes have affected these electrification rates in rural areas.

The trend in electrification levels of households (national, rural, and urban) seems to indicate that the Electricity Act (2006) amended in 2019, has not had a significant impact on electrification levels in the rural areas in Kenya. Using the data on electrification levels of rural households as a proxy for the poor, it appears that for the foreseeable future, the poor will not have access to grid electricity (Onyango, et al., 2013). The Electricity Act (2019) does not address this problem. The only reference made to electrification is concerning the Rural Electrification Fund, but the Act does not provide guidance on how the rural population (who form the bulk of the population) will be electrified.

Access to electricity has been cited as a crucial element and one of the infrastructure "enablers" upon which Kenya Vision 2030 is anchored. The successful transformation of rural economic productivity as highlighted in the Vision will greatly depend on the supply and access to adequate, reliable, clean, and affordable electricity services. The level and intensity of commercial electricity use in rural areas is a key indicator of the

degree of economic growth and development (IEA, 2021). It is in this regard that this thesis on regulatory reforms and their effect on rural electrification is envisaged.

Regarding county electrification rates (Table 1.2), Nairobi has the highest rate (96.7%), followed by Mombasa (86.3%) and then Kiambu at 91.9% while counties with the lowest electrification rates are Turkana (8.8%) and West Pokot (11.9%).

Table 1.2: County Electrification Rates

County	Access to electricity (%)
Baringo	28.7
Bomet	22.1
Bungoma	21.8
Busia	26.2
Elgeyo-Marakwet	24.7
Embu	47.3
Garissa	24
Homa Bay	18.5
Isiolo	40.6
Kajiado	67.9
Kakamega	25.2
Kericho	45.5
Kiambu	91.9
Kilifi	38.6
Kirinyaga	66
Kisii	39.5
Kisumu	52.8
Kitui	17.2
Kwale	31.1
Laikipia	42.7
Lamu	43.6
Machakos	48.2
Makueni	20.4
Mandera	15.8
Marsabit	21.2
Meru	40.6
Migori	23.5
Mombasa	86.3
Murang'a	60.5
Nairobi	96.7
Nakuru	64.3
Nandi	30.7
Narok	19.9

County	Access to electricity (%)
Nyamira	43.2
Nyandarua	41.6
Nyeri	72.0
Samburu	14.6
Siaya	19.6
Taita–Taveta	48
Tana River	26.1
Tharaka-Nithi	35.3
Trans-Nzoia	38.1
Turkana	8.8
Uasin Gishu	63.9
Vihiga	38.6
Wajir	14.6
West Pokot	11.9

Source: Commission of Revenue Allocation (December, 2022)

1.1.4 Kenya's Electricity Regulation Institutional Structure

Two major institutions are in charge of regulating the electrical subsector in Kenya. While the Ministry of Energy is in charge of creating overall policy, the EPRA is in charge of regulating petroleum product importation and movement as well as power generation, transmission, and distribution. This organizational structure was established as a result of reforms that divided the responsibilities for the energy sector's commercial, regulatory, and policymaking activities. The objective of the energy policy is to ensure an affordable, sustainable, and reliable electricity supply to meet the national and county governments' needs while protecting and conserving the environment. EPRA which replaced the ERC as a national entity, is mandated by the Energy Act (2019), to ensure regulation, exploration, and investment (upstream) in the electricity energy subsector. According to Kerlin (2024), this has to be done while seeking a delicate balance between protecting the consumer, the investor, and other stakeholder interests on behalf of the state as an independent corporate entity.

The Energy Act, 2019 also establishes the Energy and Petroleum Tribunal whose aim is to hear appeals to decisions that are made by EPRA as a quasi-judicial entity. The third entity created by the Energy Act 2019, is the Rural Electrification and Renewable Energy Corporation (REREC). This body succeeded the Rural Electrification

Authority (REA). The role of REREC is to facilitate a faster rural electrification process in collaboration with the national and county governments. REREC is also mandated to undertake research and develop and maintain a rural electrification master plan. The roles of the actors in the sector are provided in the table below

Table 1.3: Actors and Roles in Rural Electrification in Kenya

No.	Institution	Functions
i)	Ministry of Energy and Petroleum	Setting sector policies and overseeing energy planning, development and mobilization of financial resources
ii)	Energy and Petroleum Regulatory Authority	Regulating the energy sector. It provides a forum for citizen participation in the decision marking and a redress system for citizen complaints against actors in the energy sector
iii)	Energy and Petroleum Disputes Tribunal	Determines disputes and cases in the energy sector
iv)	Rural Electrification and Renewable Energy Corporation	Undertakes the implementation of rural electrification projects, including renewable energy planning and implementation in rural areas, including off-grids. Establishing energy centres in counties.
vii)	KPLC	A partly privatized distribution company and grid operator

1.2 Statement of the Problem

Effective electrical reforms should increase people's access to electricity. Mwangi, et al. (2023) establish a link between reforms and improved accessibility, affordability, effectiveness, and service quality of electricity. As a result of regulatory reforms, it is anticipated that the electricity subsector will receive stronger incentives to cut costs and improve service quality in a way that is both cost-effective and provides quick access to investments in regulated infrastructure services (Foster et al, 2020; Mwangi et al, 2023). The population that is not connected to the national grid should also significantly decline after decades of power sector reform, according to expectations.

For Kenya, however, this is not yet obvious (IEA, 2023; Lee et al., 2016 Mwangi et al., 2023). Rural electrification rates have been modest, with only 65% compared to 80% for the rest of the world (World Bank, 2023). In this situation, limited access to electricity is stifling rural economic growth and impeding efforts by numerous communities to enhance their standards of living (World Bank 2023).

There is a huge disparity between Kenya's poverty levels and electrification rates (Lee et al. (2016), According to studies, most notably by Lee et al. (2016), demand for electricity in Kenya's rural areas is significantly suppressed. Only 50% of people living in rural areas are poor, but close to 55% of them lack access to electricity (KNBS, 2022).

In order to improve the quantity, quality, and accessibility of power, particularly for the rural population, Kenya has launched a number of governance changes. The commissioning of independent power producers (IPPs), the creation of independent power regulators, and the unbundling and liberalization of the electricity sector, which left Kenya Power with only one function—power distribution—instead of generation as it had previously done—are among the noteworthy reforms. There has also been the adoption of various service delivery reforms such *Umeme Pamoja*, revolving fund schemes, and *Stima loans* introduced by Kenya Power. However, there is limited empirical evidence regarding the effects of these reforms on improvement in the quality of services and access to electricity in rural areas. In addition, the cost of household electricity connection is too high for most households so the electricity networks constructed in rural are underutilized (Lee et al 2016). This has made alternative power providers particularly solar energy companies very attractive.

Electricity regulation is a political process that involves the interests of many actors and institutions and their governance structures (Njiru, 2008; Oxfam, 2024). The nature of local politics in Kenya and the relationship between elected officials and those in charge of public companies has given rise to strong local interest groups whose needs cannot be simply ignored, even when the law would compel them (Zhang et al., 2008). This implies that local politics influence electricity sub-sector reforms (Oxfam, 2024). Even though this is still a poorly understood aspect of Kenya's power sector

reforms, it nevertheless explains why the country's current access to electricity is uneven, with Nairobi having an access rate of 96.7%, Kiambu has 91.9%, Uasin Gishu has 63.9%, Kwale has 31.1%, Kakamega has 25.2%, Siaya has 19.6%, Kitui 17,7%, and West Pokot has 11.9% (CRA, 2022). Politics in nation-building constitute a "black box" that determines whether regulatory reforms are successful or unsuccessful and this is unique to each country (Karekezi et al, 2009).

Furthermore, the fact that national electrification has increased from 18% in 2002 to 75% in 2023, implies that the rural household's access to electricity is considerably lower than the urban households. Therefore, there appears little connection between regulatory reforms in general and rural grid electrification goals. Similarly, since electricity regulation is a political process that involves the interests of many actors and institutions and their governance structures, the measurement of its reform outcomes regarding access has to be put into an institutional context (Oxfam, 2024).

In Kenya, literature is limited on the effects of regulatory 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 access to electricity in the rural areas of Kenya. For instance, recent studies by Mwangi et al (2014) and Lee et al. (2016), have all focused on the drivers of the adoption of electricity in rural areas.

In addition, even though contextual factors such as political environment, existence of alternative power sources as well as household characteristics (age, Gender, education, marital status of household head, and household income), have been found to influence access to electricity in rural areas elsewhere (Wanyoike, 2012; Oxfam, 2024), available literature in Kenya has paid little attention to their effect.

Arising from this concern, the study sought to analyze the effect of regulatory reforms on the access to electricity in rural areas of Kenya with the inclusion of socioeconomic factors. The study addressed one broad question: what is the effect of regulatory reforms on access to electricity in rural Kenya?

1.3 Objectives

1.3.1 The General Objective

The general objective of this study was to analyze the regulatory reforms in the electricity energy sub-sector and their effect on access to electricity in rural areas of Kenya.

1.3.2 Specific Objectives

1. To analyze the effect of institutional reforms on electricity access in rural Kenya;
2. To establish the effect of governance reforms on access to electricity in rural Kenya;
3. To determine the effect of service delivery reforms on access to electricity in rural Kenya;
4. To evaluate the extent to which socio-economic factors, and political and alternative power sources intervene in the effect of regulatory reforms on the access to electricity in rural Kenya.

1.4 Research Hypotheses

To examine the influence of each of the independent variables on the response variable, the study hypotheses included the following:

H_{01}: Institutional reforms have no significant effect on electricity access in rural Kenya;

H_{02}: Governance reforms have no significant effect on access to electricity in rural Kenya;

H_{03}: Service delivery reforms have no significant effect on access to electricity in rural Kenya;

H_{04}: Socioeconomic factors, political and alternative power sources have no significant effect on access to electricity in rural Kenya.

1.5 Justification of the Study

The achievement of Vision 2030 depends heavily on ensuring efficiency in the delivery of electricity and competitiveness in its pricing. The degree and extent of efficiency with which reforms in the electricity energy subsector are well-thought-out, efficiently implemented, and enforced will determine the extent to which these objectives are achieved on a sustainable basis and in an environmentally sound manner. Therefore, quality, affordable, and accessible electricity energy services must be made available to all economic sectors, including manufacturing, mining, agriculture, and households, on a sustainable and cost-effective basis, especially those in rural areas. Only then can development outcomes be guaranteed.

The government has undertaken a number of reforms to improve accessibility for the rural people. There is, however, no empirical data on how these measures have affected Kenya's rural electrification. The goal of this study was to advance knowledge and discussion in the field and, ideally, to improve the empirical framework for determining how reforms affect socioeconomic outcomes. In this case, the study generated data-based policy recommendations that will help the government to improve the design of energy sector reforms to increase access to electricity in rural areas to reduce poverty.

The findings of the study support the establishment and implementation of government policies that can result in better, more comprehensible, and more sustainable power services for development and economic progress, particularly for the underprivileged in rural areas. The evidence will also probably result in consumer-friendly laws and other measures that might increase grid connectivity. This study attempts to address the question of whether prior regulatory reforms addressed the issue of "energy access" for the populace or if they instead added to the growing issue of inadequate and ineffective energy services for those living in rural Kenya.

1.6 Scope of the Study

This study is about the role of electricity energy reforms undertaken to provide an understanding of how these reforms can be better designed and delivered to improve rural electrification in Kenya. Ultimately, the goal is to contribute to the eradication of poverty through improved access to in the rural areas of Kenya.

The study was carried out in Kenya. The study covers the electricity subsector of the energy sector with particular emphasis on the national grid extension and not any other power sources and the players involved with the regulation and distribution of electricity to the rural areas including the distributor, Kenya Power (KP), Rural Electrification and Renewal Energy Authority (REREC) and Energy and Petroleum Regulatory Authority (EPRA) and households in the rural areas. The study also targeted civil society groups focusing on energy issues particularly those involved with alternative energy solutions in rural areas.

The study was focused on Kakamega, Nyandarua, and Uasin Gishu counties. Kakamega County was selected because, despite being the third largest county in terms of population and being favored with a vibrant agricultural economy, it is one of the least electrified counties with a rural electrification rate of 25.2% (CRA,2022). Uasin Gishu County which has a comparable rural economy is 63.9% electrified (CRA, 2022). Nyandarua stands somewhere in the middle with a 41.6% rural electrification rate (CRA,2022).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews both theoretical and empirical literature on regulatory reforms in the electricity sector and their effect on access to electricity. The chapter discusses the theoretical framework, the conceptual framework, a review of study variables, and an empirical literature review. The review of the literature is inclined towards identifying research gaps on reforms in the power sector and their effect on access and consumption of electricity and hence economic development.

2.2 Theoretical Framework

A theory is a well-organized set of ideas about a certain subject or phenomenon. Theories categorize and explain a wide range of particular facts or behavioral descriptions (Epictatus et al., 2005; Newing, 2011). This study was guided by the following theories: Regulation, New Institutional Economics (NIE), and Capability theories.

2.2.1 Theory of Regulation

According to regulation theory, also known as public interest theory, the implementation of regulation is based on the public's demand for the correction of unjust or inefficient market activities. Nachmias & Nachmias (2008) assert that the main objective of regulation is to advance society as a whole rather than a particular vested interest. According to Khanna and Zilberman (1999), the regulatory body is believed to represent the interests of the society in which it operates rather than the state's particular interests. According to this hypothesis, markets are extremely fragile and, if left unchecked, will choose to function very inefficiently (or unfairly). The assumption is that the government will act as an impartial arbiter. However, there may be a conflict between commercial practices (such as maximizing profit) and the interests of persons utilizing public services as well as those of those who are not directly involved in transactions (externalities). In order to manage these tensions,

government regulation is therefore justified (Khanna and Zilberman, 1999). In other words, regulation ensures the provision of a safe and adequate service without impeding the efficient operation and growth of business.

The analysis of regulation can be positive or normative. Positive regulation examines why regulation occurs. In general, regulation occurs to; overcome information asymmetries and a desire on the part of the government to align the operator's interest with the government's interest, satisfy the customer's desire for protection from market power when competition is non-existent or ineffective, and satisfy operator's desire for protection from the government opportunism (Correa, 2006; Castillo, 2009; Boyeko, 1996). Normative regulation theories of regulation generally conclude that regulators should: encourage competition where feasible by obtaining information and providing operators with incentives to improve their performance, minimize the costs of information asymmetries by obtaining information, and providing operators with incentives to improve their performance. Regulation is also adopted to provide for price structures that improve economic efficiency and to establish regulatory processes that provide for regulation under the law and independence, transparency, legitimacy, and credibility for the regulatory system (Castillo, 2009). According to this idea, government regulation is how the drawbacks of imperfect competition, unbalanced market operation, a lack of market information, and unsatisfactory market outcomes can be overcome (Joskow, 2005; Fabrizio et al., 2007; Dawson, 2009). Therefore, the study will make use of this theory to comprehend how different regulations in Kenya's electricity sub-sector have affected the connectivity of the rural population to the national grid.

2.2.2 New Institutional Economics

According to this theory, institutions are crucial in deciding effective solutions to organizational problems in competitive environments (North, 1991). Because competitive markets produce greater knowledge of consumer needs and producer supply costs, economic regulation can only "mimic" the social welfare effects of competition in a "second-best" approach (Sidak et al, 1998). Therefore, for effective resource allocation and efficient service delivery, competition is strongly preferred

over state regulation. According to this paradigm, Williamson (2009) contends that in order for a private enterprise system to function correctly, property rights must be formed in resources. This is accomplished when a person who wants to utilize a resource must pay the owner in order to do so. The government relinquishes control once property rights are established and their enforcement is guaranteed, and the judicial system becomes necessary to settle conflicts (Coase, 1959). When assessing the performance of utilities, Levy et al (1994) further developed this approach, emphasizing how important it is to maintain market stability through market competition and the upholding of property rights. According to them, utility services have the following features: (i) economies of scale and scope; (ii) very particular and non-deployable; and (iii) a wide variety of domestic consumers. According to the New Institutional Economics (NIE), these qualities produce issues that threaten conventional market procedures. Because economies of scale, and scope, are highly specialized assets, there may be very few providers of essential utility services; nonetheless, given the volume of domestic use, it is likely that utility pricing eventually becomes a political issue. Additionally, due to these characteristics, utilities are extremely vulnerable to administrative rules that affect private utility investments, as a result of price caps, stringent investment requirements, and labor contract clauses.

The institutional endowment of a country consists of the following 5 elements: 1) the legislative and executive institutions, which are in charge of choosing legislators and executive branch officials as well as passing laws and regulations; 2) the judicial institutions, which include formal procedures for choosing judges, determining the internal structure of the judiciary, and resolving conflicts between private parties or between private parties and the state; 3) customs and norms that regulate how people and institutions behave; 4) social interests, ideologies, and the balance between them; This notion is crucial for comprehending how institutions contribute to rural electrification.

In a country's case, policies are implemented by organizations and their practical implementation may be very different from the interventions with which they were designed. According to North (1990), institutions are “the humanly devised constraints that shape human interaction.” This implies that institutions are the ‘rules of the game’

in a society which underscores human interaction. They seek to go beyond the restrictive assumption of perfect competition by using such concepts as the principal-agent problem and transaction costs. In the context of the regulative agency, providers deliver a service to society which underscores human interactions. This **r**eflects the thinking by North (1990) who argued that social interest, ideologies (norms & customs), and their balance within society or organization, constrain the actions of individuals and actors.

Given that the government's intention for reforms in the electricity sub-sector is to ensure accessibility of electric energy to all of Kenya, the theory will guide the study in understanding whether political, social interests, or ideologies of individuals or organizations constrain the implementation of reforms and how that affects access to electricity in rural Kenya.

2.2.3 Capability Approach

The pioneering writings of Amartya Sen (1992) in welfare economics, social choice, poverty and hunger, and development economics have had a significant influence on the capability approach or human development approach. The fundamental tenet of the capability approach is that social structures should work to increase people's capacities in order to support or realize the things they value doing and being. As a result, capability is a collection of functional vectors that indicate an individual's flexibility to lead a particular kind of life (Sen, 1992).

"Value and have reason to value" is a crucial part of the notion of functioning (Severin et al., 2009). Things that people appreciate makeup functioning. In other words, a situation or action only counts as functioning for a person if they value it. In this instance, change is significant only to the extent that it yields outcomes that people value. According to Brown et al. (2006), a livelihood capability includes the possession of human capabilities like education, skills, health, and psychological orientation. It is the chance to combine the best aspects of what a person is capable of doing as a human being (Sen, 1987). A person's capacity reflects their actual flexibility to select among a variety of functional arrangements and ways of living that they have

good reason to appreciate. The capabilities approach's core interaction focuses on resources and utility.

The ability to appreciate valuable functioning is a capability. In this sense, a person's true and real options are referred to as their capabilities. Giving people the option to select from a variety of functional configurations will enable them to improve their capabilities. This is the aim of development and policy. Building human capability would entail providing individuals with health, knowledge, education, a sense of responsibility, and material riches. According to Severin et al., (2009), this is what empowerment entails. The goal of development is to create an environment that allows people to live long, healthy, and productive lives. The capability approach takes into account every facet of development, including international commerce, economic growth, the budget deficit, and technological advancements. The development model's components are all included under its purview. Widening people's options and enhancing their lives are the goals of development. In the context of electricity service providers to rural areas, capabilities entail consideration of distributive justice, efficiency, empowerment, and participation of the people in service provision. Participatory development, which is concerned with the procedures by which individuals engage as agents of their development, results in empowerment (Kimuyu, 2000). It is about the freedom to decide on issues that affect their life and the freedom to have an impact on community development.

Equity, sustainability, productivity efficiency, and empowerment are the four key pillars of the capabilities approach (Mahbub UlHaq, 2004). Equity contains a consideration for distributive justice amongst groups and is based on the concepts of justice, impartiality, and fairness. Efficiency is the best utilization of already available resources. Empowerment comes from participatory development, which focuses on the processes by which individuals act as agents of their development. The freedom to make decisions that will affect their daily lives and the freedom to influence societal progress is at stake. Sustainability is the ability of development to continue in the presence of environmental constraints. It means increasing human progress in a way that ensures long-term social, political, financial, and technological benefits.

The capabilities approach assumes a human rights component when it is applied to the household. This is based on the idea that genuine development ought to encourage involvement, public discourse, and democratic practice. The household as an agent of development pursues goals and seeks services that it values and seeks to value. As an agent of local-level development, the household seeks to advance its well-being by seeking utility services that empower it to be better.

Analyzed from this perspective, a capability theory would posit that a household decision to access electricity in rural areas would be determined by the extent to which electricity expands an individual's valued things such as expanding and entrenching access to knowledge through the promotion of education and reading culture, empowerment through access to information and sustainability of the economic activities that occur at the household level (Sabina et al 2004).

These capabilities are also the concern of various international, regional, and national human rights instruments. The African Charter on Human and People's Rights (1981) recognizes the importance of civil and political rights as a prerequisite for social and economic empowerment. The UN Declaration on the Right for Development acknowledges that sustainable economic and social improvement of the well-being of all individuals is based on their active, free, and meaningful participation in development and fair distribution of the resultant benefits. In the Kenya constitution (2010) the Bill of Rights article 27 sub-section (1) obligates the government to provide equal protection and benefit to all the people in the context of access to public utility services. Key to the conceptualization of capability as a human right is the emphasis on the human person as the central subject, active participant, and beneficiary of development. A capability approach focuses on expanding choices and opportunities so that each person can lead a life of respect and value. In a sense, human rights and human capabilities are complementary (tend to reinforce each other) and in the process, expand people's capabilities and protect their rights and fundamental freedoms (UNDP 2000). A human rights approach also prioritizes social and economic policies and their reforms in order to facilitate the provision of basic services to those people left out. The application of the capability approach focuses on the need to

reform institutions or organizations and mobilize resources to sustainably provide basic services including electricity.

As a human right, the capability approach argues that individuals should be treated with respect and not as a means to an end (Sabina et al 2004). Since the state/ government is obligated to provide basic services as a matter of duty, capability theory would go beyond this right and look at the institutional framework that allows this right to be fulfilled. It seeks to examine the economic, social, political, and cultural institutions which constrain or enhance the fulfillment of this right.

The analysis of the role of regulatory institutions and the various regulatory reforms and their effect on access to electricity in rural areas will be guided by the assumption that service providers have a duty to provide electricity while the household retains the freedom to evaluate the usefulness of this service to achieving its valued things. The trade-off implies that the household becomes the main theatre of decision making which is fueled by current and future livelihood choices. These choices are unique and diverse and subject to constant changes. This theory will be instrumental in assessing the household decision-making process regarding whether to be connected or not to be connected. This is based on the understanding the service providers and regulatory institutions (REREC, EPRA & KP) have a duty and obligation to provide electricity to all citizens devoid of any form of discrimination.

Even though Sen's Capability Approach has been criticized for failure to account for the relative dominance of negative freedom vis-à-vis positive freedom, capability theory can still be applied to understand the underlying motives for household needs and the challenges they face in accessing electricity power. Positive freedom is the possession of the power and resources to fulfill one's potential whereas negative freedom is non-interference by other people (Christopher, 2013). In some ways, the Capability Approach variants that distinguish between internal capabilities and the external conditions necessary to acquire these capabilities appear to emphasize negative freedom more. However, Sen does recognize "the special significance of negative freedom" for the Capability Approach (Sen, 1992). He contends that a lack of positive freedoms and the violation of personal rights might lead to capability failure

(Sen, 1985a). Additionally, Sen believes that negative freedom has inherent as well as basic relevance, in contrast to some capacity theorists (who tend to reject personal liberty, such as Nussbaum, 2005b) (Sen, 1985a). Sen's capabilities approach is also constrained by his emphasis on ensuring that individuals have access to their liberties in order for them to reach their full potential. Some of the freedoms particularly the political discretion of decision makers if not properly checked could infringe on the freedoms of others or could end up being misused. This notwithstanding, the capability approach has great potential for human development since people are allowed to exploit their full abilities and contribute to national development in the long run.

2.3 Conceptual Framework

A conceptual framework, according to Cooper and Schindler (2008), is a brief explanation of the phenomenon under study that is offered coupled with a graphic or visual representation of the study's important variables. The conceptual framework of this study (Figure 2.1) illustrates the connection between electrical sector reforms and access to power in Kenya.

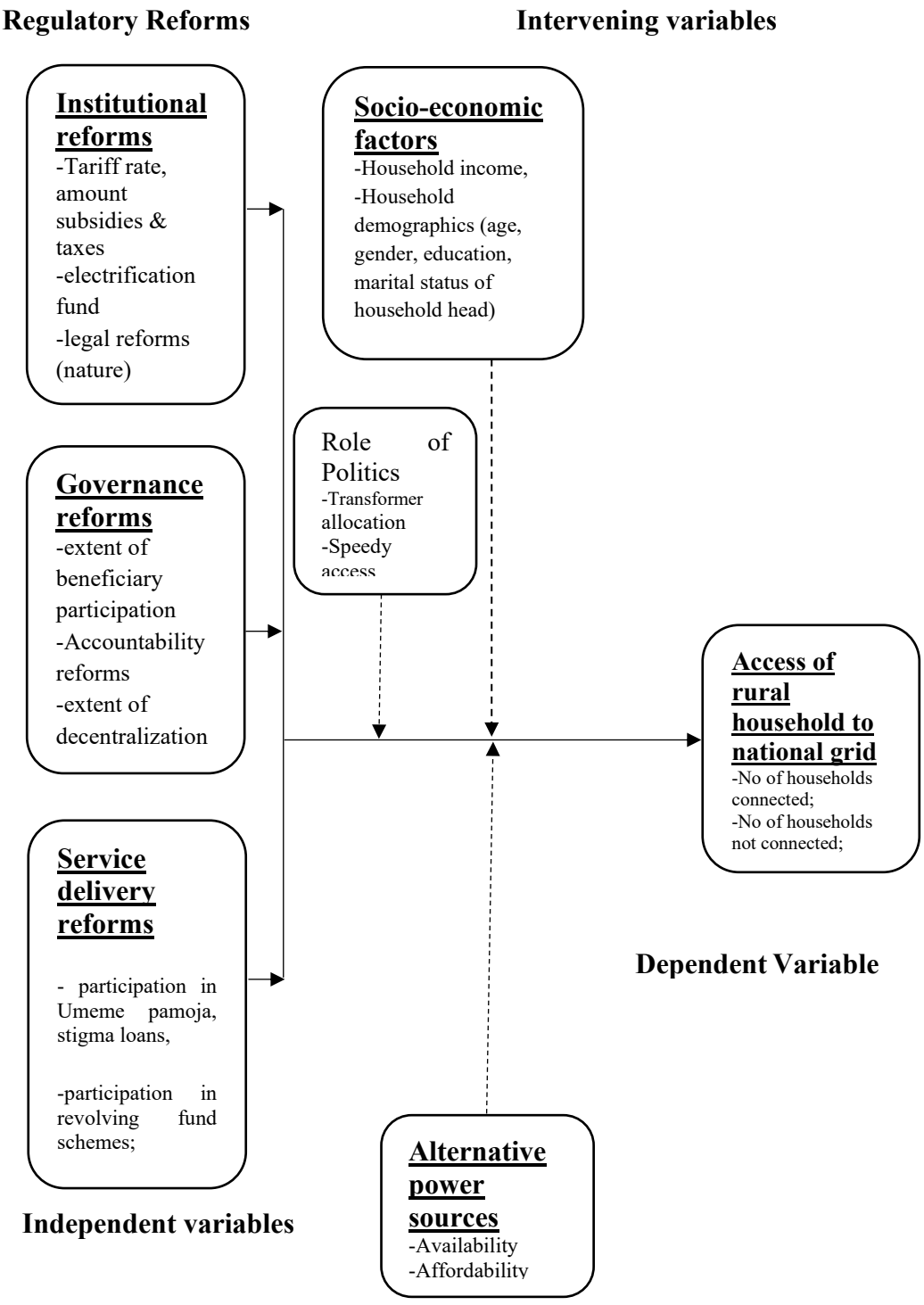

Figure 2.1: Conceptual Framework

2.4 Review of Variables

In accordance with the conceptual framework of the study shown in Figure 2.1, institutional reforms, governance, and the cooperative model are independent factors, whereas access to the national grid is the dependent variable. In addition, the study incorporates socioeconomic factors as intervening variables to determine their effect on the household's decision to connect to grid electricity.

2.4.1 Institutional Reforms

Literature already in existence suggests that institutional reforms in the electricity power sector have an effect on rural electrification. The goal of the study is to assess the effects of institutional reforms on rural electrification, including changes in tariffs, subsidies, and, financing levels and the presence and nature of legal reforms. Access to electricity is likely to be negatively impacted by rising tax rates on electrical equipment (material). Taxing revenues for businesses directly engaged in energy generation and delivery will also adversely affect access to electricity in the rural areas. It is anticipated that inadequate financing for electricity subsector organizations like REREC and EPRA, as well as minimal subsidies and high tariff rates, will result in lower rates of electrification in rural areas. The type of legislative structure in the power sector may also have an impact on electrification rates. Therefore, it is anticipated that weak institutional reforms will negatively affect rural electrification.

2.4.2 Governance Reforms

Governance is defined as the process in which decisions are implemented or not implemented or the manner in which public affairs are conducted (World Bank, 1994; Kaufmann, 2000). "Governance" is the "manner" in which power is exercised in the management of a country's socio and economic resources for development. Kaufmann (2000) further looks at government in three practical dimensions – process by which those in authority are selected, monitored and replaced. In this respect, the examined the effect of decentralization of decision-making centers for energy regulation and service providers; economic dimension – the governments capacity to effectively manage its resources and implement sound policies; institutional respect dimension –

the respect of citizens and the stake for the country's institutions. In this case, participation of stakeholders (customers) in the decisions of electricity subsector actors, i.e., their knowledge and views on various reforms and incentive programs was investigated to ascertain how it affects access to electricity in the rural areas. Accountability for the management of resources provided to the energy sector regulators and service providers was also examined in line with of Auditor general questions.

2.4.3 Service Delivery Reforms

There have been successful stories regarding the effect of cooperative models such as revolving funds, loans among others on rural electrification around the world as a way of reforming the electricity sub-sector. Electricity loans, and revolving fund schemes help poor consumers to raise money for connectivity without which they would not have done. The study therefore set to investigate the presence and effectiveness of Kenya's cooperative models towards electrifying rural households. The models studied are Umeme Pamoja (Electricity together), revolving fund and Stima Loans (electricity loans). Participation into these models is of the essence for this study. The study expects a positive relationship between participation into these models by the rural households and access to electricity.

2.4.4 Socio-Economic Factors

Socio-economic factors of the households are incorporated in the study as intervening variables. The study recognizes that electricity reforms may not directly affect the connectivity of electricity and hence, the idea of intervening variables. For example, low incomes among rural households might affect the willingness to buy and result into low connections despite policy reforms to lower connection charges. Additionally, household heads with higher levels of education are more likely to have access to electricity than those with lower levels of education. This is due to the possibility that educated people may be better able to appreciate the benefits of clean energy, which may increase their desire for power.

2.4.5 Role of Politics

Particularly in emerging nations, politics is likely to be a major factor in the connectedness of the rural households to the electricity grid. This is based on the fact that politicians are likely to use access to electricity as a campaign tool to propel them into office (Godinho et al, 2019). However, the role of politicians in allocation of transformers or power line/power stations is a good idea, but may jeopardize the government aim of equitable distribution of electricity across the country.

2.4.6 Alternative Power Sources

The existence of alternative power sources such as solar energy, biogas and kerosene among others could explain access to electricity. In this case, availability, type, reliability and affordability in relation to electricity as well as people's attitudes can affect the impact of regulatory reforms on rural electrification.

2.4.7 Access to Electricity

This is the study's dependent variable which is going to measure whether a household is connected to the national grid or not. The information on the number of households connected and those not connected will be collected to establish reasons behind the two scenarios.

2.5 Empirical Review

Empirical literature is reviewed in terms of thematic areas (institutional reforms, policy reforms, governance, innovation and contextual factors and their relationship to access to electricity in the rural areas in Kenya).

2.5.1 Institutional Reforms and Access to Electricity

Different studies that have assessed regulatory reforms in the infrastructure sector have considered the United States model of the independent commission as their benchmark of comparison and analysis. The US model emphasizes agencies that make decisions independently from the Executive Branch, are subject to the accountability of

parliament and have budgeting autonomy (Andreas et al., 2007; Oxfam, 2024). However, according to Booth et al (2013), effective provision of public goods and services are only likely when empowered citizens and mobilized civil societies begin to hold the government to account.

Studies have asserted that reforming the institutional framework leads to efficiency gains that can be realized in various sectors including higher productivity, higher capacity utilization and lower system losses (Zhang et al. 2008). Participation of the private sector in the energy sector is lauded as effective only when independent regulatory agencies exist (Pollitt, 1997). Similar arguments were made by Ezor (2012) in his study in Uganda where rural electrification is carried out by the private sector who are faced with insufficient supply of generation that is not equal to demand. This results into market failures where rural electricity connection becomes high and hence forcing private distribution enterprises to load-shed by selectively cutting off power to some consumers, leading to unreliable power supply in rural areas.

A study by Zhang et al. (2008) using panel data for 36 developing and transitional economies over the period 1985 – 2003, analyses the effects of privatization, competition and regulation on the electricity generation industry. The findings indicate considerable effects of reforms on electricity accessibility. However, this study concluded that regulation and privatization proffer little gains while competition effectively stimulates performance improvements. Similar observation was advanced by Jamasb et al., (2005); Figueiredo (2010); and Boss (2013).

The aim of structural and policy reforms in the energy sector is to electrify the rural population (Barnes et al., 2005; Victor et al., 2009; Kowsari, 2011). However, several economic and social factors can limit rural electrification. Examples of these factors are as follows: household capabilities, cultural traits, attitudes, preferences, and experiences; alternative energy sources; the physical environment and availability; accessibility; and the reliability of energy. According to Barnes et al. (2005), the government ought to influence these variables, if the reforms in the electricity sub-sector are to be successful and result in electrifying rural areas. These variables are; accessibility, affordability, disposable income, and the availability of high-quality

modern energy sources. As we shall see from the findings of this study, one of the major barriers to the uptake of grid electricity is affordability.

Increased access to electricity in developing countries is significantly influenced by the cost of energy, particularly for low-income households. The best strategy to lower electricity prices and expand access, is to offer electricity subsidies through the construction of spread tariff structures. Studies done by Brown et al. (2006) for Tanzania and Holmes (2003) for Zimbabwe support this view.

Reforms that focus on lowering the cost of power will therefore have the biggest impact. Because of the role it plays in ensuring socio-economic, political, and environmental sustainability, it is crucial to comprehend the nature of energy demand dynamics and its primary drivers in a nation. According to the KIPPRA Report (2009), households used more electricity after the value added tax (VAT) on electricity was reduced by 4% in 2007. However, these gains were undone in 2013 as a result of the Financial Act of 2013's implementation, which raised the VAT to 16% KIPPRA 2022).

Consumers have a variety of price structures to choose from with efficient pricing systems/rates, such as variable rates that account for varied lengths of time and expenses as well as fixed rates that incorporate risk premiums for price guarantees (Fabrizio et al., 2007). According to this study, efficient rates give customers more options since they take into account the fact that individuals have different preferences for how much they value rate/bill against the lowest predicted cost. Although the costs of metering technology have been a barrier to wider adoption, meters that can accurately record consumer usage on a regular basis are required to support pricing that varies hourly or daily. The potential benefits of rising price responsive demand are estimated in a wide range of ways. Based on numerous assessments of time-of-use and real-time pricing schemes (KIPPRA,2022), economic efficiency can dramatically increase, resulting in reduced annual resource costs and increased consumer value.

Lifeline tariffs which are designed to make electricity affordable to low-income households by charging less for low levels of usage, have worsened the situation in Kenya (Abdullah, 2007). This is because of high incidence of low-income households in rural areas which undermines the commercial viability of electricity provision.

Changes in the policies regarding industrial regulation have impact on the provision and consumption of public services. For instance, Barnes (2011) argues that establishment of independent regulators in an industry brings accountability, transparency, efficiency and effective service delivery. Centralized energy sector acts a barrier to accessibility of electricity among the underprivileged population (Barnes, 2011). According to KIPPRA (2007), changes to legislation that establish monopolies over power supply in Kenya were aimed at facilitating rural electrification. Other studies have observed that levying of uniform tariff as it is in Kenya and its application to mini-grid system is a barrier to development of viable models for supplying electricity to rural areas (Bernard, 2012; Wanyoike, 2012).

From this literature, it is evident that reforms in the institutions are often undertaken to improve the performance of such institutions. It has also emerged that reforms alone cannot bring about the desirable change if other factors such as capability and institutional cultures are not in line with the proposed changes. Despite this, the literature does not make it clear how the changes to the electricity sub-sector affected rural electrification in Kenya. This information will therefore serve as the study's basis for determining the impact of institutional reforms in the energy sector on Kenya's rural electrification.

2.5.2 Governance Reforms and Access to Electricity

The effectiveness of regulatory reforms has been attributed to governance levels and regulatory quality. Studies by Cubbin and Stern, (2006) for 28 developing countries from 1980-2001and that of Nicholas (2011) have argued that a regulatory law and higher quality governance are positively and significantly associated with higher per capita generation capacity levels and that this positive effect increases overtime as experience develops and regulatory reputation grows. Nicholas (2011) observes that good governance has eight major characteristics which include: participatory, accountability, transparency, responsiveness, effectiveness, efficiency, equity and the rule of law. These ensures minimal corruption, the views of the minorities and the poor are considered and the voices of the most vulnerable in society are heard in decision

making as well as responsiveness to the present and future needs of a society (Mbatia, 2011).

Empirical evidence from Africa and Asia suggests that those countries in which public utilities are stronger and effective are invariably those that make the greatest effort to practice good governance (Eberherd, 2006; Castillo, 2009). This suggests that good governance protects the long-term value of energy resources by ensuring that regulatory agencies are more accountable to the general public and better manage public finances. These studies also contend that prosperous nations typically adopt an integrated, holistic approach to service delivery that includes demand management, tariff determination, transparent pricing mechanisms, and research and development, all of which are carried out through public-private partnerships (PPPs). Strengthening electricity governance by involving the participation of civil society groups, consumers and the private sector, shapes how decisions are made, and this can lead to more equitable and sustainable electricity policies which might enhance rural electrification (Oxfam, 2024).

In essence, the issues facing the energy sector in many developing countries, are ones of governance (World Bank, 2023), which show up as disjointed institutional structures. A lack of definition of roles and responsibilities, questionable resource allocation, patchy financial management, and weak implementation capacity (Onyango et al., 2009, Godinho ,2019). This includes widespread resource leakage from the sector, lax political and regulatory responsibility, ambiguous or nonexistent regulatory settings, and an unpredictable environment for private sector actors to make investment decisions (Holmes, 2003). When the governance system does not meet the prerequisites for effective governance, such as inclusion, accountability, participation, openness, predictability, and responsiveness, poor governance results (Aggarwal, 2014).

Decentralization and liberalization of the power sector have been found to lead to effective power supply. Brown and Mobarak (2009) established that, dismantling monopolies in the power sector to allow for private players, brings competitiveness which enhances effectiveness in the sector whose benefits trickles down to the final

consumers. Similar findings were noted by Jain (2006), Brown and Mobarak (2009) and Burke (2012). However, Fabrizio et al., (2007) found no effect of privatization of electricity on accessibility to the national grid particularly in the rural areas. Decentralized governance is key to participative decision making and selection of choice of technology that reflects local needs (IEA et al, 2020). According to the constitution of Kenya (2010), energy is a shared responsibility for national and county governments. The energy act 2019, clearly delineates the specific role for each level of government. The county government is responsible for regulation of energy at the county level as well as licensing of biomass and biogas facilities. However, according to KIPPRA (2022), county governments lack the capacity to effectively regulate energy activities and fund rural electrification programmes in their areas of jurisdiction.

In line with chapter 10 of the constitution of Kenya (2010), public participation is regarded as part of national values and principles of governance. The energy act of 2019 has institutionalized the participation of stakeholders, particularly the consumers in the decision-making processes of EPRA. According to KIPPRA (2022), stakeholder involvement helps to translate citizen needs into the organizational goals and creates a basis for effective strategy development.

Limo et al (2023), carried out a study titled 'Community engagement and implementation of of rural electrification projects in Kwale county. Using a descriptive research design, the study sampled 137 individuals in the study area. The findings show that participation of the people in rural electrification projects enables the beneficiaries to have an increased understanding of project goals and objectives. This finding concurs with Kareithi et al, (2018), who argued that involving communities in planning and implementation of all the stages of a project increased ownership and sustainability of projects. The study also points out that community participation leads to better project outcomes and improved quality of electrification projects. However, KIPPRA (2022), has pointed out that rural households do not have the capacity for effective participation, given their limited knowledge regarding the functions of regulation and service delivery organizations such EPRA, REREC and KP.

Literature indicates that policy reforms such as tariffs/pricing, decentralization & privatization of industrial regulations in the energy sector influences electrification, efficiency and effectiveness in the sector. However, there is limited literature on how policy reforms in the electricity sub-sector in the power industry affects rural electrification. There is also a contradiction in the literature on whether decentralization and privatization of the sector enhances electrification. This therefore calls for further investigation.

In summary, the reviewed literature show that good governance reduces corruption in public institutions, promotes transparency and accountability which ultimately leads to better service delivery. These empirical revelations are very crucial to this study whose aim was to investigate the effect of governance reforms on rural electrification in Kenya. Indeed, the study sought to answer the question, "have governance reforms in the electricity sub-sector affected in rural Kenya?''

2.5.4 Service Delivery Reforms and Rural Electrification

Studies have documented successful stories resulting from the application of cooperative models as a way of delivering services in the energy sector as well as enhancing rural electrification. For example, Bangladesh's Rural Electrification Board (REB) works with rural communities to establish local electrical cooperatives known as PalleBidyntSanitites (PBS) (Yarduo et al., 2010). Regarded by UNDP (2009) as one of the most successful rural electrification programmes within the LDC's, PBS's draw up an electrification Master Plan for their own operational areas and their members (the rural consumers) participate in decision making through elected representatives to the PBS governing body (UNDP, 2009 P. 25). Through the cooperative model, the PBS is able to attract lower retail tariffs, higher subsidies, training of members in cooperative management and investment in distribution infrastructure. In rural Bangladesh electrification rates, have increased with many households connected. According to UNDP (2009), 47,650 villages now have electricity supplied to their homes following PBS'S installation of 219,006 Kilometers of distribution lines. Furthermore, over 170,000 irrigation pumping stations also receive electricity due to the PBS's efforts in rural Bangladesh (Yarduo et al., 2010).

Senegal's revolving fund scheme for electricity connectivity has positively affected its rural electrification plan (Niang, 2006). The scheme finances connection charges as part of the initial bill at no interest rate. Those who are financed are expected to repay back within 12 months' period to avail money for financing others. In Botswana, the government advances soft loans to rural households for up to 95 percent of the connection charges (Alexandria, 2010). The remaining 5% connection charges are met by the households. Alexandria (2010) established that this scheme had marginally increased number of new customers. However, Wanyoike (2012) observed that high default rates on these loans reduce long-term efforts of an institution charged with the responsibilities of advancing loans which can lead to the collapse of the schemes.

Stima Loan is an innovative National Revolving Fund which was recommended for KPLC following a socio-economic survey carried out in the year 2006 by a consortium of consultants targeting the low-income segments particularly in the rural areas (Wanyoike, 2012). The KPLC later partnered with Equity Bank to enable needy customers access credit from an internally managed Revolving Fund (RF) for payment of electricity connection. It was established to facilitate electricity uptake among the low-income segments and enhancing the revenue base of Kenya Power Company. Omechi et al (2014), carried out a study to determine the effects of Stima loans on increasing level of electricity connectivity by low-income customers in Kenya. Using a descriptive design, the study found that Stima loans had increased the customer base of Kenya power. Given that the process of applying for Stima loan is fairly simple, it had attracted many low incomes people in the rural areas. However, these findings do not concur with those of Namwakira et al, (2017). In their study, Namwakira et al (2017) have pointed out that the uptake of Stima loans has been low due to the requirement of deposit from new customers which often is too high for low-income rural based household. The study also points out that high interest rates charged on the loans as well as loan processing fees has disincentivized the loan uptake among low-income households. While the high deposit requirements and processing fee has increased the profitability of Kenya Power, it increased the total cost of electricity access which discouraged potential customers. Namwakira et al (2017) further established that, since the deposit amount depended on the customers income level, it was inadequate for most low-income rural customers who avoided it. This shows that

many researchers do not agree on the effect of stims loan as a service delivery innovation for accessing electricity in the rural, hence this study.

Due to the high initial expenses associated with rural electrification, a subsidy is frequently required (Brown et al., 2006). The construction of decentralized off-grid technologies or the expansion of the electrical network could both benefit from this. The most typical type of subsidies utilized in Kenya and most African countries are cost sharing agreements, where governments (or development partners) pay a portion of the cost of grid extension or installation of an off-guide system. Cross subsidization is a popular strategy that results in indirect contributions from homes who already have access to electricity through higher electricity bills. However, this payment is not means tested, implying that both poor and rich benefit from the subsidy (Karekezi and Kimani, 2009).

Existing literature shows that various cooperative models around the globe have a positive impact on the electrification rates. However, little is known about these programmes in Kenya's cooperative versions such as Umeme Pamoja, Revolving Fund and even Stima loans. Arising from this concern, the study sought to find out how these cooperative models have affected rural electrification in Kenya.

2.5.5 Socioeconomic Factors and Access to Electricity

The role of socioeconomic factors as 'contextual factors' in the success of the regulation reforms has been analyzed in literature on regulatory reforms and their effects on the access and consumption of electricity (Green et al, 2006). However, the analysis remains inconclusive particularly for the case of developing countries. Key among these factors includes characteristics of household heads (income, gender, marital status and education).

Demand for electricity is correlated with household income among the rural population in developing counties. Burke (2012) found that households with low-income are generally ready to pay for minimum level of services (clothing, food, medical care and shelter). But after meeting this, their demand becomes highly elastic. Studies further show income to be a prime driver of electricity connection; reporting strong correlation

between income increase and connection of electricity (Mwangi et al,2023) According to Onuonga (2008) and Aggarwal (2014), the low demand for energy for a long time is caused by the poverty levels in these countries. According to Godinho et al (2019), households with relatively high incomes have more purchasing power than those with low incomes. Burke (2012) makes a similar observation, noting that developing countries with limited access to electricity are suffer a vicious cycle of poverty. However, Mishra (2010), has argued that income cannot be a key determinant of electricity connection as he found a negative correlation between household income and electricity connection in his studies for India. According to Lee et al (2016), even with subsidies, as in the case of *Last mile Program* in Kenya, connection rates remained fairly low in western Kenya, suggesting that price policies may not fully explain the observed low levels of electricity connectivity. Furthermore, despite the availability of *Stima Loans and Stima Pamoja*, electricity uptake is still, quite limited, particularly among the poor households, who are reluctant to engage in long-term financial commitments

Other studies have also found out that awareness, education, and social learning also influence the rate of electricity adoption (Brown et al., 2006; Mbatia, 2011; Bernard, 2012; Wanyoike, 2012). Equally, some of the obstacles to the adoption of an energy source include lack of awareness about the associated benefits. Similarly, the perceptions of rural households about the benefits of electricity energy also play an important role in the adoption of the source (Peters et al., 2009). Lack of information regarding the socioeconomic benefits of electricity have been shown as a barrier towards household adoption (Whitfield, 2006). Rural households 'perception of the benefits of electricity' is perhaps the greatest driver that determines the household adoption of electricity in the rural areas. Nevertheless, Andwea et al (2022) suggests that the low rural household's electrification rate is mainly because of a perception that it as a luxury service rather than a necessary social service and economic enabler. In addition, fears of vaguely understood billing system, and delayed installation and erratic supplies also undermine connectivity (Mbatia 2011; Bernard, 2012). Furthermore, Electricity supply factors such as, availability, accessibility and reliability also influence choice and adoption of electricity (Barnes et al., 2005).

Availability of power grids not only affect electricity adoption but also change service demands among households (Davis 1998; Heltberg, 2005).

Gender roles substantially influence decision making on energy at the household level. According to Clark (2021), though women are the main end-users of energy, they are limited in their involvement in planning and implementation levels of most of the projects in the energy sector. In Kenya, women generally have less power than men to make decisions about electricity appliances (Winther et al 2020; Clark 2020). According to ENERGIA (2020), 82% of household electricity supply connection Kenya was in the man's name. Often women are not in a position to make or influence decisions concerning energy use (KPPRA, 2021). Traditional gender roles, therefore, result in different patterns of energy use between men and women and imply that women stand to gain disproportionately from rural electrification (Clark 2020). Lack of land ownership documents which is the basis for signing of electricity supply contracts explains women's lack of decision-making power over access to electricity (ENERGIA, 2020). According to Nishimwe et al. (2014), female-headed households were consistently less likely to be connected to the main source of electricity than those headed by males.

Distance of the household from the transformer is a determinant of electricity access among households (Lee, et al, 2016). Transformers act as electricity access points for rural households (REA, 2013). Distance of the households to a nearest transformer is measured to determine the upfront cost of connection. The closer the transformer is to a household residence, the more likely the households will be connected to the grid electricity. Standards set by the energy utility indicate that households within 0.6 km from a transformer get a subsidized cost of connection to the power grid (World Bank 2018). Under the Last Mile program, the Ministry of Energy in Kenya announced that it would help families to get connected at a cost of USD 171 (KES 15,000). The Phase I criteria for applicants to enjoy the low connection fee was that the household needed to be within 600 metres of an existing transformer. (Lee et al, 2016). Prior to 2015, the electricity connection fee, at a fixed price of USD 398, was unaffordable for households particularly in low-income rural areas (Lee, et al, 2016). Many people viewed the

connection charges as a luxury and were not willing to pay for it, even if they could afford it (Ibid, 2016).

2.5.6 The Role of Politics and Access to Electricity

Empirical evidence shows that the relationship between politicians and their people explains the degree to which the citizens hold the politicians to account, including provision of inclusive public services (Golden and Min, 2012). An imperfect relationship will undermine efficiency and effectiveness of the distribution of public services, leading to skewed resource allocation. This may lead to skewed extension of the electricity grid in favor of some groups, diversion of resources for patronage or rent seeking. Brown and Mobarak (2009) observe that in democratic countries with democratic institutions, there is a balanced allocation of public resources. Brown and Mobarak (2012) further noted that where political accountability for electricity is weak, the distribution of electricity to some groups and the allocation of subsidies are used for political advantage.

Similar arguments were advanced by Golden and Min (2012); Oda and Tsujita, (2012) who observed that electricity distribution is liable to political capture by local elite. G (2006) noted that the duration of electric power availability is longer in more developed areas than less developed areas. Other studies attribute the problem of low electricity connectivity particularly in rural areas to political mismanagement of energy institutions (Okwiri, 2006; Dawnson, 2009). Okwiri (2006), for instance, makes the case that three things—incomplete decentralization, the murky character of local politics, and stakeholder capture of vital resources—have thwarted attempts to ameliorate the situation through public sector reforms un general and power sector reforms in particular. The clientelist nature of local politics and the alliances that politicians and administrators have formed with "traditional" authorities and local strongmen have resulted in the creation of local interest groups that are powerful and whose interests cannot be easily disregarded, even when legal requirements would require it (Correa, 2006).

Berry (1993) asserts that access to any essential natural resources depends more on social networks and relationships than it does on legal frameworks. In such settings, the local outcomes of reforms are entirely driven by local politics and interests. For example, in South Africa, Black South Africans did not have access to power prior to the 1994 democratic transition due the fact that post 1994 electricity reform process was frustrated by complex web of political interests at the local level and the fear of loss of control of an important infrastructure service and large income streams (Eberhard, 2006). The commitment of the new black economic elite to future electricity reforms could be dictated by the sizes of the shares of privatization rents and political rewards. Similarly, access and distribution of public services in many regions in Kenya seems to be politically motivated and determined (Newing, 2011).

2.5.7 Alternative Power Sources and Access to Electricity

Studies have found that the nature, availability and affordability of alternative power sources influences connectivity to the national grid (Newbery, 2004 and KPPRA, 2007). For instance, according to Newbery (2004), the majority of people in rural Kenya can afford biomass energy that is produced from woodlands, farms, bushlands, closed forests, plantations, and industrial and agricultural waste. Kenya's forested lands provide more than 45% of the country's biomass energy, which is used as a primary alternative energy source in both rural and urban areas. Solar and wind power are also more cost-effective than other energy sources like nuclear, fossil, coal, hydro, and liquefied petroleum gas. KIPPRA (2007) reports that a minor portion of the population uses diesel and hydroelectric power. Therefore, access to alternative sources of power, notably solar has affected the access of rural people to electricity in Kenya.

It is evident from other studies that, despite reforms in the electricity sub-sector, there are some factors which may either enhance or discourage access to electricity. Such factors include political influence, household awareness and level of education, alternative power sources, household income levels among others. These findings are therefore very important for the study which seeks to find out the role played by contextual factors towards the uptake of electricity in rural Kenya.

2.6 Critique of the Existing Literature

Even though much work has been done regarding regulatory reforms and access to electricity in rural areas across the globe, existing empirical literature on the effects of regulation reforms on access to electricity in Kenya's rural areas is still inconclusive. Most of the studies have used cross country and panel data while at the same time employing diverse variables to proxy for efficiency and regulatory quality (Pollit, 1997; Jamasb, 2004; Yardoo et al., 2010). Other studies have largely investigated the effects of regulatory reforms on economic development where they have concluded that reforms in the electricity sub-sector augments economic efficiencies of the firms and states (Pollit, 1997, 2005, Jamasb et al., 2004, 2005; Lee et al., 2016). Still other researchers (Ezor, 2012 and Kowsari, 2011) argue that regulation reforms and privatization alone are not instrumental for efficiency gains and need to be implemented together with competition enhancing measures. There was a need therefore, to investigate the effects of regulatory reforms in the electricity sub-sector in Kenya with the most current data.

2.7 Research Gaps

There is a paucity of material in Kenya about the effect of regulatory reforms in the electricity sub-sector on rural electrification. There have been a few studies done, but they have mostly concentrated on the factors that affect electrical connectivity rather than how well the reforms have worked to improve access to electricity rural areas. All of the most recent research, including those by Mwangi et al. (2023) and Lee et al. (2016), have concentrated on the factors that affect the uptake of electricity in rural regions. For example, Mwangi et al., (2014), researched on the determinants of electricity adoption with technology, cost of capital, research and development as the only factors under investigation. In addition, this study only targeted Rural Electrification Authority officials leaving out the beneficiaries, civil society groups and other regulatory agencies such as KPLC, and EPRA for which this study intent to incorporate.

Furthermore, Mwangi et al. (2014), employed descriptive statistics only, while this study will also use correlation analysis besides descriptive methodology to bring out a clear understanding of how various policies (regulations) have affected on rural electrification. The study will also look into how improvements to the electricity system, alternative power sources, cooperative models, and political and economic factors—all of which Mwangi et al. (2014) and Lee et al. (2016) excluded—affect the availability of power in rural areas. The Lee et al., (2016) study was similarly constrained in that it solely focused on Western Kenya (Busia and Siaya counties) and examined the factors that determine access to power rather than how regulatory reforms affect that access.

2.8 Summary

From this literature, reforms in the institutions are always intended to enhance the performance of such institutions. Accordingly, reforms alone cannot bring about the desirable change if other factors such as capability and institutional cultures are not in line with the proposed changes. It has also emerged that good governance promotes transparency and accountability which ultimately leads to better service delivery in public institutions. Furthermore, existing literature show that policy reforms in the electricity sub-sector influences electrification, efficiency and effectiveness in the sector. In addition, other contextual factors, such as the social and economic makeup of the homes, politics, and the availability of alternative energy sources, might help to explain access to electricity, particularly in rural areas. There is, however, little research on how changes in Kenya's power subsector and environmental conditions affect access to electricity.

In conclusion, it is clear that previous research was not thorough, which has advanced the discussion on how reforms might encourage rural electrification. Additionally, none of the research done to date in Kenya on the impact of institutional reforms on access to electricity has been conducted on a national level. The effect of regulatory reforms in the electrical sub-sector on access to power was thus the subject of this study, the first of its kind to be conducted on a nationwide scale.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the study methodology, which has ten sub-sections. It contains the research design, study area, target population, sample size and sampling techniques which are covered in sub-sections 3.2-3.5 respectively. Sub-sections 3.6-3.10 contains discussions on data collection tools, reliability, validity, data collection procedures and analyses in that order.

3.2 Research Design

A research design, according to Orodho (2009), is a blueprint or strategy used to come up with solutions to research challenges. This study considered both the relationships and the strength of the interaction between the predictor factors on the results of the dependent variables. In the present study, a cross-sectional research design was used. This design was appropriate for describing data that is gathered at a certain period to characterize the nature of the current conditions and figure out the connections between particular events and situations (Mugenda &Mugenda, 2018). The design was thus appropriate for explaining how reforms in the electricity sub-sector impact rural residents' access to electricity.

The cross-sectional design was appropriate for incorporating mixed research methods. In the mixed approach, both qualitative and quantitative data analyses were carried out simultaneously in a cross-sectional manner. In Mugenda and Mugenda (2019) mixed approaches are classified into mixed models and mixed methods. Under the mixed model's approach, descriptive data analysis was undertaken independently, followed by inferential data analysis. Under the mixed methods approach, both descriptive and inferential data analysis are carried out sometimes in a cross-sectional integrated manner (Mugenda, 2019; Gall et al., 2007). Creswell (2009) argues that mixed methods are a powerful way to enhance the validity of results through triangulation.

The mixed methods approach moves away from the extremes of the objective nature of reality advocated by positivism in quantitative designs and the subjective nature of reality propagated by phenomenological paradigms in qualitative designs. Therefore, in this study, both qualitative and quantitative aspects of the regulatory reforms were investigated. This is unlike positivism which requires the researcher to distance himself/herself from the research or phenomenological designs which removes the researcher's independence with their research (Gall, 2007; Mugenda, 2019). The mixed method has the epistemological advantage of freeing the researcher to selectively interact with research. Thus, the weakness of one approach is neutralized when combined with another (Cresswell, 2009). Therefore, there is a balance between quantitative research which is value-free without any form of emotional bias, and qualitative research which is potentially value-laden.

To incorporate social aspects of managers/leaders into what they actually do, the study applied Institutional Ethnography (IE) following the work of Dorothy Smith (Adams, 2015). According to Smith, researchers should try to understand how people's thoughts and actions are coordinated with the thoughts and actions of others. In IE, studies seek to disclose how particular ways of knowing or doing are mediated by people's everyday engagement. The key areas of questioning were related to the nature of the regulatory reforms that have so far occurred in the electricity energy subsectors and their effects in facilitating access, affordability, and efficiency of electricity for economic development in rural areas and the role of political motives in rural electrification. Questions were therefore targeted to institutional reforms, pricing and innovation strategies, and as well as governance reforms. IE was applied to focus group discussions and key informant interviews.

3.3 Study Area

This study targeted three counties selected from four regions of KP (Western, Mt. Kenya, Eastern, and Nairobi). These included: Kakamega from the western region, Uasin Gishu from Rif Valley, and Nyandarua from Mt. Kenya region. The reason Kakamega county was chosen is that it has the third-largest population after Nairobi and Kiambu counties. However, the county's electrification rate is very low (25.2%)

and also has a high number of rural households. Uasin Gishu is the most populous county in the Rift Valley. This county was majorly selected because of its relatively higher electrification rate (63.9%) in the region to enable the study to understand the dynamics behind variations in electrification, keeping in mind that reforms apply across the board. Lastly, the study selected Nyandarua county from the Mt. Kenya region because of its relatively low electrification rate (41,6%), and yet the county has been in a region with political powers since independence. These helped the study to explain the influence of political patronage on the allocation/consumption of electricity services.

3.3.1 Kakamega County

According to the KNBS (2019), Kakamega county is the second most populous in Africa after Nairobi. The county, which is located in Western Kenya, contains twelve (12) constituencies, including Malava, Lugari, Mumias, Matungu, Lurambi, Shinyalu, Ikolomani, Butere & Khwisero, twelve (12) sub-counties, 24 divisions, 72 locations, and 233 sublocations. Counties Siaya, Vihiga, Bungoma, and Nandi all border the region on the west, south, north, and east, respectively. According to the Institute of Economic Affairs (2013), it has an area of 3050.3 km2.

The county has a population of 970,406 females and 897,133 males, totaling 1,867,579 (Kenya Population, Housing and Census (KNBS, 2019). According to KPHC (2018), the county had 196,938 unemployed people. Statistics on employed people by industry show that 54,000 people were working in cities, while there were 756,711 in agriculture, 34,052 in self-employment, and 2,554 in wage employment.

According to the KNBS (2018), the county has 301,616 rural homes, 177 transformers, and an electricity access rate of 25.1% in 2023. According to the Integrated Household Budget Survey (KIHBS) of 2015/2016 (KNBS, 2018), The head count poverty rate in Kakamega county is 35.8 percent (672,000), significantly lower than the national average of 36.1 percent. In terms of the headcount poverty index in Kenya, the county is placed 21st out of 47 counties.

3.3.2 Uasin Gishu County

Located in the erstwhile Rift Valley Province lies Uasin Gishu County. Its borders are Trans Nzoia county to the north, Baringo county to the south east, Elgeyo Marakwet county to the east, Kakamega county to the north west, and Kericho county to the south. The county has a total area of 3,345.2 km2.

According to KPHC (2019), there are 1152671 people living in the county, with a male to female ratio of 1:1. Uasin Gishu County has six sub-counties: Soy, Turbo, Ainabkoi, Moiben, Kasses, and Kapsaret. It also has 51 locations and 100 sub-locations. The elevation of this county's highland plateau is between 1500 and 2700 meters above sea level. The head county poverty in Uasin Gishu stands at 41.0 percent or 465, 000 residents living below the poverty line, and occupies position 23 in the county ranking. This rate is higher than the national head count poverty.

Temperatures range from 8.40 degrees Celsius to 26.20 degrees Celsius, and annual precipitation averages between 900 and 1200 millimeters, with May and October being the wettest months. In terms of commercial, large-scale wheat and maize growing, this county serves as the main hub. Beans, potatoes, and peas are other crops grown in this county for both commercial and domestic use. There are 92 transformers in the county, 124,207 rural dwellings overall, and an electrification rate of 63.9% in 2023.

3.3.3 Nyandarua County

Nyandarua County is found in what was formerly Kenya’s Central Province. Nyandarua County borders five counties; Laikipia County to the north and north-east, Murang’a County and Nyeri County to the east, Nakuru County to the west and south-west, and Kiambu County to the south. The county covers an area of 3304 km^2. It is situated between Longitudes 36^o and 31^o East and between the Equator and Latitude 38^o south.

Nyandarua County has a total population of 638,289, with 51% females and 49% males, as per the National Census data for 2019. The county receives more rainfall because it is situated in Kenya's highland equatorial zone. Despite being 1,200 meters

above sea level, this county has more topography variation. The county's economy is primarily agricultural, and 53% of the population works in the tea, coffee, and dairy industries. Maize, beans, peas, Irish potatoes, vegetables, arrow roots, and sweet potatoes are some of the additional crops farmed in the county.

According to KNBS (2016), Nyandarua County has a total population of 120,123 rural households. The county with 167 transformers had an electrification rate of 41.6% in 2023. Kenya Integrated Household Budget Survey of 2015/2016 shows that Nyandarua County has a 34.8 percent poverty rate by headcount (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.

3.4 Population of Study

A population, according to Hair et al. (2006), is a large group of people, things, or events that share some observable traits. The target population for this study were households in the rural areas of Kakamega, Uasin Gishu, and Nyandarua counties (see Table 3.1).

Table 3.1: Target Population

Region (county)	Target Population (rural households)
Kakamega	301,616
Uasin Gishu	124,207
Nyandarua	120,123
Total	**545,946**

Source: KNBS (2016)

3.5 Sample and Sampling Techniques

A sample refers to units with observable characteristics selected from the population for the study. This becomes necessary if the population is too large and hence expensive to contact each individual or scattered over a big geographical area. To

arrive at the sample size, the study applied the mathematical formulae suggested by Gall et al. (2007) and successfully used by Mugenda et al (2009):

$$n= Z^2pq/d^2$$

Where;

n=is the desired sample size when the target population is greater than 10,000;
Z = the standard normal deviate at the required confidence level;
P= probability of success;
q = (1-p) probability of failure;
d= is the degree of accuracy required (in this case it is set at 5 percent)
$n = (1.96)^2*(0.5) *(0.5)/0.05*0.05$
n=0.9604/0.0025=384.16
n = 384.16
Since the target population exceeds 10,000, using Zikmund criterion, 384 respondents were selected for the study. In addition, the study sought to interview key informants from energy regulation institutions and service providers, Civil Society organizations, and Consumer organizations for qualitative data to be sampled purposively. The key institutions that were identified include REREC, EPRA, and KP and the leadership of regional Civil Societies and Consumer organizations (COs).

A proportionate sample from each county was calculated using the researcher's formula expressed as:

Sample Size $= \frac{n}{N} \times 384$, while the;

$$\text{Percentage of target population} = \frac{n}{N} \times 100$$

Where n, is the total number of households per county N, is the total number of households in the three selected counties. See Table 3.2 for the proportionate allocation of sample size.

Table 3.2: Sample Distribution by County

County	Target Population	Sample size	Percentage of total population
Kakamega	301,616	212	55.20
Uasin Gishu	124,207	87	22.80
Nyandarua	120, 123	85	22.00
Total	**545,946**	**384**	**100.00**

Source: Computed from KNBS (2016) Statistics

The proportionate allocation of the sample sizes guarantees equal opportunity for all observable units in the population to be selected and therefore fair representation. Table 3.2 indicates that Kakamega County with many households has a large sample size while Nyandarua with fewer households, has a small sample size.

On the other hand, the sampling technique is the process of selecting members of a research sample from an accessible population which ensures that the conclusion from the study can be generalized to the study population (Frankel & Wallen, 2010). This study used a multi-stage sampling method to arrive at the sample size. This sampling is ideal when a survey area is too wide such as a country, county, and district for example, as is the case for this study. Several steps were followed during the sampling. At the initial stage, the three selected counties were taken as the primary sampling units. Secondly, the three counties (Kakamega, Nyandarua & Uasin Gishu) were sub-divided into sub-counties (clusters) where 30 percent of them were selected in each county, and later 30 percent of the wards were chosen in each sub-county. The sub-counties and wards formed secondary clusters. Mugenda and Mugenda (2019) argue that 30 percent of the whole population is large enough to draw valid conclusions. There were four levels of clusters namely, sub-county, Divisions, Locations, and sub-locations. In the third stage, systematic random sampling was applied to each cluster at the ward level to select 30 percent of the households, forming the ultimate sample for the study. This ensured unbiased representation of households. A sampling at the ward level was done within the transformer community (households within 600 meters from the transformer) in each sub-location (smallest administrative unit) in Kakamega, Uasin Gishu, and Nyandarua counties to arrive at the sample size. Selecting

households within the transformer community aided in establishing the number of households with the ability to connect to the national grid. A list of administrative units (districts, divisions, locations, and sub-locations) was obtained from the county commissioner's office.

Qualitatively, the study sampled 6 key informant interviews from REREC (1), KP (1), EPRA (1), and CSOs (3) to provide a policy perspective into the study. In particular, these informants were purposefully sampled to ensure the selection of officers with a good understanding of rural electrification and reforms in the electricity sub-sector.

3.6 Data Collection Instruments

The study adopted household questionnaires and interview schedules to collect data.

3.6.1 Key Informant Guides (Interview Schedules)

An interview is an oral administration of an interview guide. It makes use of the discussion style of oral and vocal questioning. Interviews offer detailed information that a questionnaire cannot provide. They avoid asking questions that are unclear since the interviewers can make the question clearer, and as a result, the respondent provides pertinent replies. Additionally, they enable the interviewer to probe the respondent for clarification and additional information during the investigation (Kombo et al., 2006). The interviews were applied to the managers of the KP, REREC, and EPRA branch managers, leaders of consumer groups, and civil society groups.

3.6.2 Household Questionnaires

A questionnaire was used to collect both quantitative and qualitative data. The questionnaire had both closed- and open-ended questions. A questionnaire is a tool for gathering data in which participants respond to questions either in writing or orally (Borg, 2009). The household questionnaire was divided into sections related to the conceptual framework (see Appendix I). this was orally administered by well-trained research assistants.

3.7 Reliability of Data Collection Instruments

Reliability estimates the degree to which a research instrument yields consistent results after repeated trials (Fraenkel et al., 2012). Inter-item reliability was tested by determining Cronbach's alpha. The scale of inter-item reliability lies between 0 and 1 with figures approaching 1 being regarded as highly reliable. A cut-off point of Cronbach alpha of 0.5 is recommended by Peter (1979) as sufficient. This position is supported by Murphy et al (1988) who proposed that a cutoff point of 0.6 should be adopted. However, this study adopted a Cronbach cut-off coefficient of 0.70, a much higher threshold. The table shows the Cronbach Alpha test alone to determine the internal consistency of collected data. To determine if the questionnaire items were internally consistent and stable, a reliability test was required (Koshy, 2010). For each domain of the questionnaire and interview schedule, a distinct Cronbach alpha coefficient was produced to strengthen the measurement tool's reliability. The reliability coefficient for each Likert scale item in this study was calculated, and the final reliability results were reported under each study aim. Table 3.3 illustrates this.

Table 3.3: Reliability Test

Variables (check the Likert scale)	Number of items	Cronbach Alpha	Interpretation
Socioeconomic factors	17	>6	Reliable
Regulatory factors	19	>6	Reliable
Institutional factors	15	>6	Reliable
Alternative sources of power	8	>6	Reliable
Governance issues	25	>6	Reliable

3.8 Validity of Data Collection Instruments

The degree to which an instrument actually measures what it claims to is known as validity (Fraenkel et al. 2012). The study established the content validity to make sure that the data gathered using these instruments accurately reflects the variables being measured. The study used the construct validity technique to make sure that the required information was collected by the data collection tools.

Before beginning the actual investigation, a pilot study was conducted. Pilot tests, according to Serakan (2008) and Cresswell (2012), are essential to determining the validity of the study and the dependability of the used instruments. Pernenger (2011) recommended that a sample size of 30 respondents is suitable for piloting. Therefore, 30 households were selected by simple random sampling technique from the study area. However, these households were excluded from the final study.

3.9 Data Collection Procedure

The survey method was used to collect data for the study. A survey is a system for collecting information to describe, compare, or explain the knowledge, attitude, and behavior of people (Fink, 1995b). It is appropriate when individuals are the units of analysis and primary data are required to describe the population (Babbie, 2004). The population under study must however be accessible and willing to provide information to afford an understanding of the relevant state of affairs to be taken (Christensen, 2012). The survey method is selected for several reasons. Firstly, the regulation reforms in the power sector impact the diverse group of consumers namely: manufacturers (producers) domestic consumers, institutional consumers, and public utility (street lighting). The survey method was appropriate for collecting data from such a population because it allows for stratified sampling which ensures that all the stakeholders are represented in the study. Secondly, the survey method allows for data to be collected from several respondents so that their diverse experiences can be analyzed. This makes it possible to identify any patterns or attributes and characteristics of the population.

A survey approach sought to identify the extent to which reforms in the electricity energy sub-sector influence electricity access in rural areas in Kenya. This approach is in line with Gill and Johnson (2002), who used a survey research approach in a cross-sectional study in a survey to investigate human resource strategic employee orientation and organizational factors and the performance of state corporations in Kenya.

According to Borg (2007), data collection is the process of acquiring unprocessed, raw data that can later be transformed into meaningful information. During data collection, interviews were conducted by 30 qualified research assistants, 10 in each county. Local research assistants who understood the local language were recruited, trained on the research process and ethics, and later deployed to collect data with the aid of a structured questionnaire. In total, 384 questionnaires were administered across the three counties.

Research protocols were observed including anonymity and confidentiality of the data collected. Voluntary participation was also ensured by obtaining the consent of all the participants before the interviews. The National Commission for Science, Technology, and Innovation (NACOSTI) authorization was sought and granted.

3.10 Data Analysis and Presentation

According to Gall et al. (2007), data analysis is the technique used to arrange and organize raw data in order to extract valuable information from it. The research's aims and hypotheses guided the data analysis. The goal of the study was to ascertain how different reforms in the electrical sub-sector affected rural electrification.

In order to evaluate the hypotheses and forecast the link between the dependent and independent variables, the study performed descriptive and regression methods. Both qualitative and quantitative data were produced by the study. The categorization of content and identified important study criteria were used to analyze the qualitative data in light of the study's goals. Statistical tools including frequencies, bar graphs, measures of central tendency, and measures of dispersion were used to present quantitative data.

Multi-regression analysis was used to examine the simultaneous effects of several independent variables on a dependent variable was the interval scaled (Sekaran, 2008). Multi-regression analysis is important in understanding how much of the variance in the dependent variable is explained by a set of predictors. Existing literature reveals that despite the reforms, several factors are believed to be behind the slow expansion of rural electrification. Some of the key factors cited are governance, institutional

reforms, adopted rural electrification models, and contextual factors such as political and alternative power sources.

The effect of reforms in the electrical energy sub-sector on access to electricity in rural Kenya was examined using multiple logistic regressions. When there are at least two independent variables, as there were in this study, and the dependent variables are dichotomous (binary), logistic models are appropriate. The correlation between access to power and the reforms in the electricity sector was predicted by these regressions. According to the study, households have the option of either connecting to the national grid (EA_1) or not (EA_0). The assumption is that the decision to connect to electricity is a function of a vector of reforms in the electricity subsector (Xi), a vector of socio-economic characteristics, and a stochastic error term (ε). Therefore, the decision by a rural household to connect to electricity is expressed as:

$$\mathrm{EA}_1 = (\mathrm{X}_i, R_i) + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Taking an assumption that the error term (ε) in equation (1) is normally distributed, a logit model was used to estimate the effect of reforms in the electricity sub-sector on access in rural areas.

The probability that a household connects to the national grid was estimated as:

$$EA = \beta_0 + \beta_1 IR + \beta_2 GR + \beta_3 SDF + \beta_4 SEF + \beta_5 PF + \beta_6 APS + \varepsilon \ldots\ldots\ldots\ldots (2)$$

Where;

β_0= Constant (common intercept);

IR = Indicators of institutional reforms

SEF= Indicators of Socioeconomic factors and

EA= the decision to connect to electricity (EA_1) of not connecting (EA_0), which is a binary dependent variable. EA will take the value one (1) if a household is connected to electricity and zero (0) otherwise

GR= Indicators of governance reforms

SDF= Service Delivery Factors

ε =is the error term

β's are coefficients to be estimated.

PF=Political Factors

APS= Indicators of alternative power sources and

ε =is the error term while β's are coefficients to be estimated.

The dependent variable, EA, is a binary variable that shall take 1 if the household is connected to the national grid and 0 otherwise.

The study runs two regression equations. The first regression (equation 3) comprised the dependent variables and a vector of electricity reforms as the only explanatory variables expressed as:

$$EA = \beta_0 + \beta_1 Subsidies + \beta_2 Efund + \beta_3 LReform + \beta_4 UmemeP + \beta_5 Sloans +$$

$$+ \beta_6 Bparticipation + \beta_7 Accountability + \beta_8 Decentralization + e \ldots\ldots\ldots\ldots \quad (3)$$

Where;

Efund=Electricity fund

LReforms=Legal reforms

UmemeP=Umeme Pamoja

BParticipation=Beneficiary Participation

Sloans=Stima loans

The second regression (equation 4), was in addition to regulatory reforms, to bring in intervening variables (alternative power sources, age of the household head, and household income. This sought to reveal how the relationship between EA (dependent) and regulatory reforms changes with the introduction of intervening variables.

3.10.1 Hypotheses Testing

This study tested the hypotheses proposed through correlation coefficients and multilinear regression analysis. Many studies including Christensen (2012), and Gall et al., (2007), have successfully used these approaches in hypotheses testing. The direction and magnitude of the association between the dependent and explanatory variables were examined using Spearman's correlation coefficient (see Table 3.4).

Table 3.4: Testing of Study Hypothesis

Objective	Hypothesis	Type of analysis	Interpretation
1. To analyze the effect of institutional reforms on access to electricity in rural Kenya.	$H0_1$: It is expected that institutional reforms facilitate access to electricity by 80%	Spearman's correlation coefficient	If r<1-96 Reject if 4 >0.7 Strong relationship
2. Establish the relationship between Governance reforms and rural access to electricity	$H0_2$: It is hypothesized that governance reforms facilitative access to electricity in rural areas by 50%	Spearman's correlation coefficient	If r<1-96 Reject if 4 >0.7 Strong relationship
3. To determine the effect of service delivery methods on access to electricity in rural Kenya.	$H0_4$: The electricity service provision method facilitates access to electricity by 20% in Kenya.	Spearman's correlation coefficient	If r<1-96 Reject if 4 >0.7 Strong relationship
4. To establish the extent to which contextual factors influence the effect of regulatory reforms on access and consumption of electricity.	H03: It is expected that Contextual factors do not have any influence on access to electricity by 30%.	Spearman's correlation coefficient	If r<1-96 Reject if 4 >0.7 Strong relationship

Spearman's correlation coefficient is a non-parametric measure of the direction and strength of monotonic relationships (Wooldridge, 2009). This measure differs from Pearson's correlation which measures linear relationships only. Spearman's correlation is denoted by r_s and ranges between -1 and 1 ($-1 \leq r_s \leq 1$). According to this analysis, a negative coefficient implies a negative relationship while a positive implies a positive correlation. On the other hand, when r_s =0, it means no correlation. Wooldridge provides a guide to describe the strength of a relationship (see Table 3.5).

Table 3.5: Interpretation of Spearman's Correlation Coefficient

Coefficient	Strength of correlation
0.00 to 0.19	Very weak
0.20 to 0.39	Weak
0.40 to 0.59	Moderate
0.60 to 0.79	Strong
0.80 to 1.0	Very strong

3.10.2 Description of Variables

The study investigated how institutional reforms, governance, cooperative model, and socio-economic factors explain access to electricity in the study area. Table 3.6 presents a definition of the elements of these explanatory variables, how they were measured, and their expected impact on the dependent variable (Access to electricity).

Table 3.6: Variables

Variable	Description	Unit of analysis
Access to electricity	This is a dummy variable for household connectivity to electricity or non-connectivity	Number of households connected or not connected to electricity 1=household connected to electricity, and 0 otherwise.
Subsidies	This is a financial aid given by the government to the electricity sub-sector to increase the number of households connected go the national grid. The study will find out whether the amount subsidies have any impact on electricity connection in rural areas	Knowledge of subsidies
Tariffs	Tariffs refers to prices, rates, costs and all other electricity charges including adjustment costs. The study is set to establish if the tariff rates have any relationship with the demand for electricity in rural areas.	Knowledge of Tariff
Funding	The level and type of funding for Rural Electrification Authority, Energy Regulatory Commission, Kenya Power is likely to influence reforms and thereby impact on access to electricity by households	Knowledge of electrification fund
Legal reforms	Presence of legal reforms within Rural Electrification Authority, Energy Regulatory Commission and Kenya Power can influence the demand for electricity	Extent of legal reforms
Beneficiary participation	Participation of households in decision making regarding policies/reforms in the electricity sub-sector can influence demand for electricity in rural areas.	Beneficiary participation 1=there is participation, 0 otherwise
Umeme Pamoja (together electricity)	This is a collaborative KP programme initiated in 2005 with an aim of increasing rural connectivity to the national grid. This study aims to establish the effect of this programme on rural area electrification.	Participation in Umeme Pamoja schemes 1=participates, 0 otherwise
Electricity loans (Stima loans)	The study will find out whether the Stima loan programme has affected the rate of electricity connectivity in rural Kenya.	Participation in Stima loans 1=participates, 0 otherwise

Variable	Description	Unit of analysis
RFund (Revolving Fund)	The study will find out whether the revolving fund programme by KP has affected the rate of electricity connectivity in rural Kenya.	Participation in the revolving fund scheme 1=participates, 0 otherwise
Aps (alternative power sources)	The study will establish if the presence of alternative power sources in rural Kenya affects the demand for electricity amidst the reforms in the electricity sub-sector	Presence of alternative power sources
Pe(political environment)	This is a dummy variable which seeks to assess the influence of politics towards the demand for electric power in rural Kenya.	Role and type of politician influence
Hhincome (House hold income)	Economic environment will be measured by the household income	Household monthly income in Kenya Shillings
Age	Age of household head is likely to play a role in access to electricity	Age of household head
Gender	Gender of the household head is likely to influence household's connectivity to the national grid	Gender of household head
Edu (education level)	Education level of the household head is likely to influence decision of household to connect to electricity or not	Years of education of household head

The study assumed that in addition to the variables under investigation, there might be other factors that have an impact on the study subject. These elements will be taken into account by β_0.The error term (e) indicates residual factors or the interference from disturbance variables that are not included in the regression model. This suggests that the connection between the independent and dependent variables might not be linear. In the working of the electricity energy subsector the proper relationship in the model could be initiated by such factors as political interference, variations in whether conditions in the case of hydroelectric generation, instability is the foreign exchange markets, depreciation of the currency and sudden changes in personnel at the KP, EPRA and REREC.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study. The chapter is divided into five sub-sections. Sub-section 1 presents the response rate and reliability test while the second sub-section reports on the socioeconomic characteristics of the respondents. Sub-section three presents result on the descriptive characteristics concerning electricity access while sub-section four contains findings and discussion about cross-tabulations between access to electricity and selected socioeconomic factors and finally, sub-section five presents a discussion on both descriptive and inferential statistics based on the objectives of the study.

4.2 Response Rate

The study targeted a total of 384 households as key respondents from three counties, that is, Kakamega, Uasin Gishu, and Nyandarua. Table 4-1 shows the distribution of household questionnaires and the response rate across the three countries.

Table 4.1: Household Questionnaire Response Rate

County	Distributed questionnaires	Response Rate	Response rate
Kakamega	212	210	99.06
Uasin Gishu	87	79	90.80
Nyandarua	85	71	83.53
Total	384	360	93.75

The study achieved a response rate of 93.75%. This is considered more than sufficient for data analyses and making conclusions regarding the effect of reforms in the electricity energy sub-sector and electricity connection in rural Kenya. Qualitatively, six (6) key informant interviews (KIIs) were conducted with EPRA (1), KP (1), REREC (1), and 3 heads of CSOs (1 from each county).

4.3 Reliability Test

The validity of the findings is influenced in part by the dependability of the research tools. Using Cronbach Alpha coefficients, this section examines the validity of the constructs on the Likert scale. An overview of the results is shown in Table 4-2. According to the results, in every case looked at, the Cronbach Alpha coefficient was higher than 70%. This suggests that the questionnaire provided accurate, reliable, and consistent data.

Table 4.2: Reliability Test

Variables (Likert Scale)	Number of items	Cronbach Alpha	Interpretation
Constructs on electricity access	9	.705	Reliable
Constructs on regulatory reforms	10	.917	Reliable
Constructs on performance indicators	7	.911	Reliable
Constructs on regal reforms	7	.733	Reliable
Constructs on tariffs and subsidies	6	.876	Reliable
Constructs on governance reforms	14	.747	Reliable
Alternative power sources	4	.738	Reliable

4.4 Socio-economic Factors

Several socioeconomic factors were considered in the study. These factors were hypothesized to affect electricity connectivity in rural households. They included: Gender of the respondents, relationship of the respondent to the household head, age of the respondent, marital status, education level, occupation, and average monthly income. This section analyses their findings. Table 4-3 presents frequencies on gender, relationship with household head, and marital status.

Table 4.3: Descriptive Statistics on Gender, Relationship with Household Head and Marital Status

Variable	Frequency	Percent
Gender		
Female	187	51.9
Male	173	48.1
Total	360	100.0
Relationship with Household head		
Head	171	47.5
Spouse	120	33.3
Son/daughter	48	13.3
Grandchild	4	1.1
Others	7	1.9
None response	10	2.8
Total	360	100
Marital Status		
Married	251	69.7
Divorced/separated	14	3.9
Widowed	38	10.6
Single	53	14.7
None Response	4	1.1
Total	360	100

The results indicate that there were somewhat more female respondents (51.9%) than male respondents (48.1%). This implies that it is easier to find females than males in homes during the day. Findings on the relationship between the respondent and the household head indicate that the majority of those who responded to the questionnaire were household heads at 47.5% followed by their spouses at 33.3%. These imply that at least 80% of the respondents were either household heads or their spouses. In addition, 13.3% of the respondents were children from the household. It can therefore be concluded that information given on household socioeconomic characteristics was more reliable since it came from the source. Regarding marital status, 251 respondents (69.7%) were married, followed by 14.7% of unmarried respondents. Furthermore, 14.6% of them are widowed, compared to 14.6% who have split or divorced. Finally,

4 (1.1%) people omitted to say if they were married. According to the survey, the respondent's age was on average 40 years old, with a standard deviation of 14. Additionally, the age ranged from 20 to 90 at the oldest.

Next, Table 4-4 presents frequency statistics on education, occupation, access to electricity, sources of information for connectivity, and sources of financing electrification. Regarding education, the study finds that 138 respondents (38.3%) had primary-level certificates as their greatest degree of education, while 126 respondents (35%) had completed secondary education. In addition, 37 (10.3%) of individuals surveyed have no formal education, while 52 (14.4%) have tertiary-level certificates. Finally, 7 (1.9%) of the respondents omitted to state their level of schooling.

According to Table 4.4, the majority of respondents—35%—are unemployed, followed by the self-employed—31.1%—in terms of occupation. Additionally, according to these statistics, 33 respondents (9.2%) have a formal job, 50 respondents (13.9%) are employed full-time, and the remaining 8.1% are engaged in other economic activities. According to Table 4.4, just 39.4% of people in rural areas in the three counties had access to power, while 60.6% of those surveyed said they didn't have it.

Table 4.4: Frequencies on Education, Occupation and Access to Electricity Sources of Information for Connectivity

Variable	Frequency	Percent
Education		
Informal	37	10.3
Primary	138	38.3
Secondary	126	35.0
Tertiary	52	14.4
None Response	7	1.9
Total	360	100.0
Occupation	4	1.1
Formal employment	33	9.2
Self-employment	112	31.1
Daily laborer	50	13.9
Unemployed	126	35.0
Others	29	8.1
None Response	10	2.8
Total	360	100.0
Access to Electricity	10	2.8
Yes	142	39.4
No	218	60.6
Total	360	100.0
Sources of information for connectivity		
Local leaders	52	24.9
REREC-KP officials	56	26.8
Community members	53	25.4
Media	38	18.2
Others	10	4.8
Total	209	100.0
Sources of financing		
personal savings	86	69.9
Loans	30	24.4
Others	7	4.9
Total	123	100.0

On the sources of information on electrification, the study indicates that the majority of the households were informed by REREC-KP (26.8%) officers on the ground followed closely by those who obtained information from other community members (25.4%). According to Table 4-4, 24.9% of the households interviewed got information from local leaders while those who obtained information from the media accounted for 18.2%. Other sources of information accounted for 2.8%. With regard to financing, the majority of the connected households financed their electrification through personal savings (69.9%). Furthermore, loans made up 24.4% of the financing for energy access, while other sources made up 1.7%.

Table 4-5's findings on county connection show that Kakamega County has the lowest percentage of rural residents having access to electricity (25.64%), followed by Nyandarua at 49.3% and Uasin Gishu at 65.82%.

Table 4.5: County Wise Access to Electricity

County	Household connected to the nation grid (electricity)	
	No	Yes
Kakamega	74.16%	25.84%
Uasin Gishu	34.18%	65.82%
Nyandarua	50.70%	49.3%
Total	**60.56%**	**39.44%**

Next, the study asked the households to indicate what their average monthly income was in Kenya shillings. Table 4.6 indicates that the average household income in Kakamega County was Kshs. 129,438.24 with a standard deviation of Ksh. 35,416, a minimum of Ksh.400 and a maximum of Kshs. 40,000. In Uasin Gishu, the average income of the rural households was Kshs. 20,685.29 with a minimum and maximum of Kshs. 500 and Ksh.100,000 respectively. Nyandarua county had a maximum household income of Kshs. 60,000 for the rural households and an average of Kshs. 94,85.29. These statistics imply that Nyandarua county had the highest mean income for rural households followed by Kakamega county and Uasin Gishu had the least.

Table 4.6: Average Monthly Household Income (Kshs.)

County	Minimum	Maximum	Mean	Std. Deviation
Kakamega	400	40,000	29,438.24	35,416
Uasin Gishu	500	100,000	20,685.29	29,897.85
Nyandarua	500	60,000	94,85.29	16,614.84

Furthermore, the study sought to establish from the households whether the government was doing enough to electrify rural areas. The majority of the respondents, 66.7% thought that the government was not doing enough against 33.3% of those polled who argued that the government was on top of things regarding rural electrification.

Finally, respondents were asked to rate their level of agreement on some determinants of electricity access in rural areas using a scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA). Results are presented in Table 4-7.

Descriptive statistics regarding determinants of electricity access show that most households were neutral on the question of whether REREC policies affected electricity access with a mean of 3.2844. This implies that the majority of the respondents were either unaware of the policies or their operation. In addition, the majority of the households were neutral on the effect of distance from the transformer on access to electricity (3.1604). Respondents were also undecided on the question of whether household expenditure influences decisions to connect to grid electricity (2.8594). Similar results are observed with regard to the reliability of electricity supply and availability of electric appliances where a majority of those interviewed remained neutral.

Table 4.7: Determinants of Electricity Access

Construct (N=360).	Mean	Std. Deviation
Rea policies have affected electricity access	3.2844	.78609
Distance of household from transformer influences access to electricity	3.1604	.55266
REREC's reduced connection cost of electrification influences access	3.57	.935
Ability to pay electricity bill determines access to electricity in rural Kenya;	3.6246	.95521
Household level of income influences household electric connectivity;	3.6478	.95077
Household expenditure influences decisions to connect to grid electricity;	2.8594	.77173
Reliability of power supply influences household decision on the source of power;	2.9772	.73840
Decision to connect to grid electricity is informed by electric appliances (such as radio, TV, phones etc);	3.3097	.98581
Access to electricity by other community members influenced your household's decision to connect to grid electricity.	3.4794	1.08741

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

Nevertheless, the majority of the households agreed with the assertion that the ability to pay electricity bills determines access to electricity in rural Kenya with a mean of 3.6246. In addition, most households agreed that household level of income influences household electric connectivity with a mean of 3.6478. Furthermore, these statistics show that the majority of the respondents agreed with a mean of 3.4794 that access to electricity by other community members influenced your household's decision to connect to grid electricity. Generally, the descriptive results on the determinants of electricity access show that the ability to pay for electricity bills, household incomes, and accessibility to electricity by neighbors highly determine electricity accessibility relative to other factors examined in the study. These findings are consistent with a study by Burke (2012), where it was established, that low-income households are generally ready to pay for a minimum level of services (clothing, food, medical care, and shelter) and less likely to demand services such as electricity which they consider to be luxury.

The qualitative interview reveals that the majority of the households without electricity cited financial challenges as the main reason why they were yet to connect to the national grid. For instance, one respondent noted that:

> *My priority is to ensure that my children have the basics of life, that is, food, shelter, clothing, and going to school. With the little money that I get from my small business, I cannot afford the cost of connection, let alone payment of electricity bill* (hh014).

Others attributed the lack of access to electricity to poor access to information on what is involved and where to go when one has to connect to electricity. There are a few respondents who explained having been cheated by cartels due to their ignorance and were hence duped.

On the question of how they got to know about electricity connection procedures, many respondents with electricity cited the media, especially radios as the main source of information. Others reported that they were informed by their neighbors who had connected earlier while only a few households sought information from Kenya power offices. It was apparent from the responses that local offices related to electricity such as KP, EPRA, and REREC are located in major towns that are far away from the majority of the rural households. This, therefore, makes information access to electrification procedures difficult for many potential customers in rural areas.

When asked about who financed their connectivity, most respondents reported that they used their savings to have access to electricity in their homes. Few respondents had financed their connections from loans while others cited their sons or relatives having financed their electricity access.

4.5 Socioeconomic Factors and Access to Electricity

The purpose of this study was to determine how electricity reforms in the electricity energy sub-sector affected rural Kenyans' access to power. The study compared several socioeconomic traits and access to electricity in this part. Table 4-8 displays the findings in summary.

Table 4.8: Descriptive Statistics on Socioeconomic Factors and Access to Electricity

Factor	Connected to the National grid?		Total
	Yes	No	
Gender			
Female	16	25	41
Male	43	87	130
Total	59	112	171
Education level			
Informal	6	16	22
Primary	14	56	70
Secondary	18	38	56
Tertiary	21	2	23
Total	59	112	171
Occupation			
Formal employment	11	7	18
Self-employment	24	36	60
Daily laborer	7	20	27
Unemployed	12	36	48
Others	2	11	13
Total	**56**	**110**	**166**

The results confirm that out of 171 household heads interviewed, 41 were females while 130 were male. With regard to electricity connection, the results show that 59 indicated to have access to electricity while the remaining 112 have not connected to the national grid. Furthermore, the statistics indicate that more male-headed households (43) are connected to electricity than female-headed households (16). These imply that access to electricity in rural areas of the three counties is more pronounced among male-headed households.

With reference to household head level of education, the study reveals that most households whose heads have tertiary education had access to the national grid (21), followed by households whose heads possess secondary level education (18) while the least connected households are those whose heads have no formal education (6). These results imply that more educated household heads have a higher chance of connecting to electricity than the less educated. This is because, they probably understand the value of electricity as opposed to other sources of power particularly, the unconventional ones. It can also be attributed to having more ability to afford

electricity in terms of income under education. Similarly, Bernard (2012) and Wanyoike (2012) report that education level influences the rate of electricity and that low levels of awareness about the associated benefits of education have been proved as obstacles to the adoption of an energy source. Similarly, the perception of rural households on the benefits of electric energy also plays an important role in the adoption (Peters et al., 2009).

Furthermore, the study compared the occupation of household heads to the access to electricity. A summary of the findings presented in Table 4.8 shows that the least connected households are those whose household heads do not have any form of employment (12), followed by daily laborers (7), and finally by those engaged in other economic activities (2). This implies that households' heads with jobs especially those with stable income have higher accessibility to electricity than those with unstable forms of income general jobs such as daily laborers and unemployed. Consistent with these results is the study by Burke (2012) who reported that the electricity demand is correlated with household income among the rural population in developing counties. This study further noted that low-income households are generally ready to pay for basic necessities like shelter, food, medical care, and clothing but after taking care of these, their demand becomes highly elastic. In addition, Aggarwal (2014) observes that poor people have basically low electricity demand.

In summary, these findings show that male household heads are more likely to connect to the national grid than their female counterparts. In addition, the higher the level of education of the household head, the higher the chances that the house could be connected to electricity, and finally, employment of the household head may explain access to electricity in Kenya's rural areas.

4.6 The Effect of Regulatory Reforms in Kenya's Electricity Energy Sector on Rural Residents' Access to Electricity

This study focused on the counties of Kakamega, Uasin Gishu, and Nyandarua to examine the effect of regulatory reforms within the electrical sub-sector on rural Kenyans' access to electricity.

4.6.1 The Effect of Institutional Reforms on Rural Kenyans' Access to Power

The first objective of the study investigated how institutional reforms affected access to electricity in rural areas of Kakamega, Uasin Gishu, and Nyandarua counties. Results of descriptive and inferential analysis are presented in this subsection.

4.6.1.1 Descriptive Statistics

The outcomes of the study, which looked at different institutional reform initiatives such as taxes, subsidies, electrification fund, legal reforms, as regulations are reported in this subsection. Table 4.9 presents frequency statistics on various aspects of institutional reforms.

Table 4.9: Frequency Statistics on Institutional Reforms

Knowledge of taxes	Frequency	Percent
Yes	102	29.7
No	111	32.4
Don't know	130	37.9
Total	343	100.0
Knowledge of subsidies		
Yes	93	26.9
No	110	31.8
Don't know	143	41.3
Total	346	100.0
Knowledge of law adequacy		
Yes	96	28.9
No	88	26.5
Don't know	148	44.6
Total	332	100.0
Knowledge of Rural electrification fund		
Yes	87	24.8
No	154	43.9
Don't know	110	31.3
Total	351	100.0
Awareness of REF and Access to electricity in rural areas		
Yes	183	56.0
No	27	8.3
Don't know	117	35.8
Total	327	100.0

The study set out to find out whether households were aware that there were electricity levies in the first place. The results show that 32.4% of respondents claimed they were unaware of electricity taxes, followed by 37.9% of respondents who had no opinion on the matter. Only, 29.7% of the household interviewed argued that they knew about the taxes charged on electricity (Table 4.9).

In addition to quantitative data, the respondents were asked qualitative questions to determine their opinion on the effect of tax charges on electricity access. Nearly all the respondents who gave their opinion indicated that tax charges have an adverse effect on connection. Most of them argued that such charges increased both connection fees and electricity bills. A respondent argued that:

> *If the government was serious about this electrification thing, they should do away with or at least reduce these charges substantially at least for the poor (paused). How does the government expect poor people like us to pay all these taxes, we need help from the government, is it about food for our children, school, or electricity?* (hh025).

Next, the study enquired to know if the rural households were aware that the government subsidizes electricity connections. According to the results (Table 4.9), most respondents, 41.3% were indifferent, followed by 31.8% who argued that they did not know while the remaining 26.8% of the respondents indicated that they were aware of the government subsidy.

On the same question, the study sought the views of households on which form of electricity subsidy the government should give. There were divergent views on this issue. Some respondents thought that they should be given a subsidy on connectivity while others thought that electricity bills are very high for them. For instance, a respondent observed that:

> *Electricity is good and we wish that all people had it (paused) but, the problem is not the connectivity fee, since this is something, you do once and you forget (paused). The biggest issue is the payment of monthly bills* (hh001).

Another respondent noted that;

> *Am aware that the government has reduced connection charges which have seen them reduced from Kshs. 33,000 to Kshs. 15, 000 but, for what use? Even if you pay the money and get connected to the grid,*

many of us cannot afford those electricity bills we hear that people pay (hh056).

These statements imply that the government subsidy is not yet enough and this could be the reason why electrification rates in rural areas are still low.

The study reveals that the majority of respondents, 44.6%, are indifferent when asked if the law appropriately handles access to energy in rural areas. Additionally, of those surveyed, 28.9% agreed with the statement, while 26.5% disapproved. This suggests that the majority of rural households are unsure of whether or not the rules put in place to support rural electrification are sufficient.

The study also found that the majority of households, 43.9%, are uninformed of the Rural Electrification Fund (REF), with 31.3% of households showing no interest in the fund. A total of 24.8% of the households surveyed said they knew of the fund.

A qualitative interview with a REREC officer disclosed that Kenya has adequate laws with regard to electrification. He noted that:

> *The biggest challenge in Kenya is the implementation of policies and not lack of appropriate laws (paused). However, the reason why there is poor implementation is a lack of enough funds*.

Similar sentiments were shared by both EPRA and KP officials who both cited financial constraints and not laws as a hindrance to rural electrification.

When asked the question of whether a rural electrification fund helps people access electricity, most of the respondents had nothing to say. A few who managed to speak on this issue argued that they had only heard about the fund but, did not find out more about this. This indicates that the majority of the rural people are unaware of this fund and its operations.

According to the findings, the majority of the households, 56% argued that awareness of the rural electrification fund and how it operates would boost the efforts in electrifying the rural areas. Nevertheless, 35.3% of the respondents were indifferent to this while only 8.3% of the households thought that awareness of the rural electrification fund would not be useful in rural electrification.

The majority of the households interviewed were undecided about whether the establishment of REREC had improved access to electricity (60.5%), followed by 26.7% of those who claimed that REREC's existence has improved electrification. Finally, just 12.9% of respondents (see Table 4.9) believed that the REREC had not improved rural electricity. These outcomes can be linked to the majority of the rural population's ignorance of the fund.

Concerning qualitative interviews on ways through which REREC has facilitated access to electricity in rural areas, most respondents had no idea. Again, this is attributed to the revelation that most of the rural households have no clue about REREC and its activities. Only a few households (about 2 percent) who demonstrated some limited knowledge, noted that REREC enables homesteads with little cash to install electricity (a statement which is not accurate). These findings imply that most rural homes are not aware of REREC and its roles.

According to the study, most respondents (57%), followed by 24.2%, who felt that REREC's efforts are inadequate, and 18.95%, who believed that REA plays a crucial role in rural electrification, were unconcerned with the question of how effective REREC's efforts are at achieving electrification.

Qualitative interviews with REREC officials put the level of REREC’s success at about 54% percent with finance as the main challenge. They cited inadequate funding and limited donor funding as the reasons hampering their delivery. On their part, EPRA officers noted that the consumption of electricity was the main problem behind the slow pace of rural electrification. For instance, the officer noted that:

The role of REREC and KP in that matter is to ensure that transformers reach the community and not to connect to people's houses. This has been done in many rural areas but how many households are connected?

4.6.1.2 Likert Scale Descriptive Statistics on Institutional Reforms

Respondents were asked to indicate their level of agreement on various statements related to institutional reforms in Kenya's electricity sub-sector using a scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA). Results are presented in Tables 4-10, 4-11, 4-12 and 4-13. The reforms touch on regulations, legal, tariffs, and subsidies.

With regard to regulatory reforms, the majority of the households agreed with a mean of 3.54 and standard deviation of 1.01 that the regulatory framework affects EPRA's performance positively while at the same time, most households remained neutral with a mean of 3.29 on whether separation of roles (production, policy formulation, regulation, distribution) has improved the performance of EPRA. In addition, the study reveals that most respondents agreed with the assertion that Resource allocation to EPRA affects its regulatory performance.

Table 4.10: Regulatory Reforms Summary Statistics

Construct (N=360)	**Mean**	**Std. Deviation**
The regulatory framework affects EPRA's performance positively.	3.54	1.01
The separation of roles (production, policy formulation, regulation, distribution) has improved the performance of EPRA.	3.29	.99
Resource allocation to EPRA affects its regulatory performance.	2.84	1.13
Resource utilization by EPRA affects its regulatory performance.	3.75	1.01
Regulatory knowledge by regulated utilities has improved access to electricity in the rural areas;	3.28	1.12
EPRA consults stakeholders in determining tariff rates.	2.91	1.11

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

Similar results were reported concerning the statement of whether resource utilization by EPRA affects its regulatory performance with a mean of 3.75. Nevertheless, most households pooled were neutral on the statement that regulatory knowledge by regulated utilities has improved access to electricity in rural areas and that EPRA consults stakeholders in determining tariff rates with the means of 3.28 and 2.91 respectively.

Next, Table 4.11 presents a summary of statistics related to legal reforms. Most respondents were neutral on the constructs regarding legal reforms with respect to the electricity sub-sector. The descriptive statistics reports a mean of 3.23 with reference to the question of whether the Energy Act sets out a clear mandate of EPRA, KP, and REREC, and a mean of 3.18 with respect to the construct on whether the Energy Act (2019) gives EPRA the required enforcement powers for it to regulate the energy sector.

Table 4.11: Legal Reforms Summary Statistics

Construct (N=360)	Mean	Std. Deviation
Energy Act sets out a clear mandate of EPRA, KP, and REREC.	3.23	.76
Energy Act gives EPRA the required enforcement powers for it to regulate the energy sector.	3.18	.70
Energy Act is well understood by all players in the energy sector.	2.97	.77
Energy Act is acceptable to all the players in the energy sector as the primary regulatory framework.	3.07	.77
Energy Act adequately addresses the issue of electricity access to rural areas.	3.13	.82
Energy Act adequately addresses the issue of stakeholder participation in rural electrification.	3.09	.84
Legal reforms facilitate access to rural electrification.	3.17	.86

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

Similarly, most households were neutral on the question of whether the Energy Act is acceptable to all the players in the energy sector as the primary regulatory framework, and also on the question of whether the Energy Act (2019) adequately addresses the issue of stakeholder participation in rural electrification with a mean of 3.09.

Furthermore, the majority of the households interviewed were undecided on the assertion that legal reforms facilitate access to rural electrification with a mean of 3.17. The general feeling about these findings is that either most of the rural households are not aware of the legal reforms in the electricity sub-sector or, do not care about them.

These results could be attributed to the fact that most households especially in rural areas are not privy to the reforms in the sector thus, found it difficult to rate how such reforms perform with reference to rural electrification. Indeed, a qualitative interview with EPRA official revealed poor participation with households due to their ignorance of most of the policies and regulations in the industry. Next, Table 4.12 presents descriptive statistics concerning tariffs and subsidies.

Table 4.12: Tariffs and Subsidies Summary Statistics

Constructs (N=360)	Mean	Std. Deviation
You are aware of government policies on taxation, subsidies and tariffs in the electricity sub-sector.	3.43	.91
Tax on consumption of electricity affects rural electrification.	3.49	.93
Subsidies on rural electrification facilitates access to electricity.	3.42	.90
The price of electricity (monthly bills) determines access to electricity.	3.46	.98
Electricity connection charges determine access to grid electricity.	3.62	.94
Charges in price of electricity affects access to rural electrification.	3.58	1.04

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

The study indicates that most respondents were neutral on the question of whether they are aware of government policies on taxation, subsidies, and tariffs in the electricity sub-sector (3.43). When asked whether a tax on the consumption of electricity affects rural electrification, the majority of the households remained neutral (3.49). In addition, most households were undecided on whether subsidies for rural electrification facilitate access to electricity. Nevertheless, most respondents, agreed that the price of electricity (monthly bills) determines access to electricity with a mean of 3.46. In addition, the majority of the households were in agreement that electricity connection charges determine access to grid electricity with a mean of 3.62 and finally,

the respondents agreed to the assertion that Charges in the price of electricity affect access to rural electrification with a mean of 3.58.

Finally, asked households to rate the performance of EPRA based on the listed indicators using a scale of 1-5, where 1-Poor (P), 2 Fair (F), 3-Good (G), 4-Very Good (VG), 5-Excellent (E). Table 4. 13 presents summary statistics. These were household heads who acknowledged having knowledge of EPRA

Table 4.13: Performance indicators Summary Statistics

Indicators	Mean	Std. Deviation
Energy pricing.	2.49	1.21
Provision of subsidies.	2.52	1.16
Review of EIA reports.	2.42	1.13
Licensing process.	2.60	1.18
Complaint's handling.	2.38	1.19
Drafting of regulations.	2.50	1.18
Energy planning.	2.63	1.23

Mean Poor=1-1.4, Fair=1.5-2.4, Good=2.5-3.4 Very Good=3.5.4-4, Excellent=4.5-5

Concerning performance indicators of EPRA, the majority of the households indicate that EPRA has been good in terms of provision of subsidies, licensing, drafting of regulations, and energy planning with mean responses of 2.52, 2.60, 2.50, and 2.63 respectively. In addition, most households argued that EPRA has been fair in handling complaints and review of EIA reports.

Furthermore, the study sought to find out if the performance of EPRA had been affected by changes in the Energy Act. The majority of the households, 246 (68.3%) stated that they did not know with only 14 representing 3.9% of those polled reporting in the affirmative. These findings could imply that most households are not aware of the provisions/implementation of the Energy Act or the operations of EPRA.

4.6.1.3 Factor Analysis

Since the study employed Likert scales with many constructs, factor analysis's principal component approach was adopted. The method is ideal for finding factors

among observed variables. Variables with similar characteristics are grouped together. With this approach, the study was able to generate a few variables from many which can explain the observed variation from the many variables. The minimized number of variables was then used as inputs in correlation, regression, and hypotheses testing.

Table 4.14, which analyses the strength of the link between variables, first shows the findings of the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. KMO assesses sample accuracy specifically, which should be more than 0.5 for a successful factor analysis. Thus, with regard to institutional reforms, KMO was found to be .706 (see Table 4.14). Bartlett's Test measures also how strong variables are related. The null hypothesis of the test is that the correlation matrix is not an identity matrix (a matrix where all the diagonal elements are 1 and all off-diagonal matrixes are 0). The hypothesis is rejected when the p-value is less than 0.05. The results in Table 4.14 reject the null hypothesis with a p-value 0of 0.000, meaning that Bartlett's test for Sphericity is significant. This implies that the factor analysis is satisfactory.

Table 4.14: KMO and Bartlett's Test on Institutional Reforms

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.706
Bartlett's Test of Sphericity	Approx. Chi-Square	663.512
	df	78
	Sig.	.000

The following output (Table 4.15) describes the extracted factors with their eigenvalues, the proportion of variance that is attributable to each factor, and the sum of the variances of the factor and the preceding factors.

Table 4.15: Total Variance Explained on Institutional Reforms

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.307	20.968	20.968	2.307	20.968	20.968	1.771	16.100	16.100
2	1.376	12.512	33.481	1.376	12.512	33.481	1.549	14.081	30.181
3	1.242	11.294	44.775	1.242	11.294	44.775	1.480	13.451	43.631
4	1.126	10.233	55.007	1.126	10.233	55.007	1.251	11.376	55.007
5	.951	8.649	63.656						
6	.854	7.764	71.420						
7	.749	6.808	78.227						
8	.709	6.445	84.673						
9	.681	6.190	90.862						
10	.604	5.486	96.349						
11	.402	3.651	100.000						

Extraction Method: Principal Component Analysis.

Table 4.15 indicates that four factors that explain the total cumulative variance, of 55.007 have been extracted. The first, second, third, and fourth factors account for 20.968%, 12.512%, 11.294%, and 10.233 % respectively. The results imply that all other factors are not significant. Since the fifth factor (Table 4.15) has also an eigenvalue of less than 1, the study retained four factors (1-4). Factors beyond this study explain approximately 45% of the variances in institutional reforms.

Finally, the rotated Component (Factor) Matrix was computed to minimize the number of factors on which the variables under study have high loadings. Table 4.16 shows that three variables are sufficiently loaded on factor component 1, three variables are loaded on component 2, while components 3 and 4 are loaded with two variables each. Any factor component of contribution less than 0.5 was ignored in the process.

Factor component 1 is associated with taxes & subsidies, while factor component 2 is related to legal reforms. Finally, factor components 3 and 4 are associated with energy fund reforms. The study utilizes these factors to conduct logistic regression analysis and hypothesis test in the next sub-sections.

Table 4.16: Rotated Component Matrix on Institutional Reforms

	Component			
	1	2	3	4
Funding affects EPRA's performance positively			.733	
Separation of roles (production, policy formulation, regulation, distribution) has improved the performance of EPRA.			.674	
Resource allocation to EPRA affects its regulatory performance.				.727
Regulatory knowledge by regulated utilities has improved access to electricity in the rural areas;				.720
Energy Act sets out clear mandate of EPRA, KP, and REREC;		.734		
Energy Act gives EPRA the required enforcement powers for it to regulate the energy sector;		.846		
Energy Act is well understood by all players in the energy sector;		.548		
You are aware of government policies on taxation, subsidies and tariffs in the electricity sub-sector;				
Subsidies on rural electrification facilitates access to electricity;	.714			
The price of electricity (monthly bills) determines access to electricity;	.601			
Electricity connection charges determine access to grid electricity;	.555			
Charges in price of electricity affects access to rural electrification;	.673			

Extraction Method: Principal Component Analysis.

4.6.1.2.1 Logistic Regression of Access to Electricity and Institutional Reforms

Institutional factors (subsidies, laws, and the electrification fund) were regressed on access to elecricity. The Hosmer-Lemeshow Test for the model fitness, shown in Table 4.17, is the regression's first result.

Table 4.17: Hosmer-Lemeshow Test on Institutional Reforms and Access to Electricity

Hosmer and Lemeshow Test		
Chi-square	Df	Sig.
2.848	8	.944

A significant test indicates that the model is not a good fit and a non-significant test indicates a good fit. (Hosmer & Lemeshow, 2000). With the Chi-square statistic of 2.848 and p-value of 0.944, greater than 0.05, it means that the overall model is statistically insignificant, and hence, well-fitted.

The model summary results are then shown in Table 4.18 along with Cox & Snell R-square and Nagelkerke R-square, which are pseudo-R-square and adjusted R-square in OLS regression. These numbers show a lower predictive power for the independent variables, which predict the dependent variable by roughly 5%.

Table 4.18: 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

The classification table (Table 4.19) 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 after, each of the probabilities is compared with the cut-off point value. The findings show an overall percentage of the probabilities of 62.6%, which is greater than the cut value of 0.5 or 50%. This indicates a high level of accuracy.

Table 4.19: Classification Table on Institutional Reforms and Access to Electricity

	Observed		Predicted access to electricity		Percentage Correct
			no	yes	
Step 1	Access to electricity	No	193	22	89.8
		Yes	111	30	21.3
	Overall Percentage				62.6

a. The cut value is .500

The final output contains the logistic regression results with estimated coefficients (see Table 4-20).

Table 4.20: Logistic Regression Coefficients (Variables in the Equation)

	Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	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

The results of the effect of institutional reforms on access to electricity are shown in Table 4.20. Results from logistic regression can be understood by using both p-values and odd ratios (Exp (B)). According to the computed coefficients, institutional reforms and access to power have a favorable relationship. Subsidies and legal reforms are all statistically significant, according to the p-values (Sig). These imply that they are more likely to lead to access to electricity in the rural areas of the counties under study. However, the analysis falls short of demonstrating the importance of energy funds on access to electricity. The cost of electricity is a significant factor in determining access to electricity for low-income populations, according to Brown et al. (2006) and Holmes (2003). Additionally, KIPRA (2009) contends that households used more electricity as a result of the value-added tax (VAT) on electricity being reduced by 4% in 2007.

Furthermore, KII with EPRA officials revealed that in setting electricity tariff factors such as affordability, economic growth, and simplicity. For instance, he noted that:

> *Electricity tariffs must be simple to understand by the consumers and must also be sensitive to economic growth.*

Regarding odd ratios, the ratio of 1.373 shows that there is a greater likelihood that changes to subsidies will have an impact on the availability of power in rural Kenya. These findings specifically suggest that a unit shift in subsidies might affect access to power by 1.373 times. Similar to this, given Kenya's odd ratio of 1.317, legal changes are more likely to disrupt power connectivity in rural areas. The availability of power in rural Kenya is thus revealed to be significantly predicted by subsidies, and legal reforms.

Numerous research conducted throughout the world have supported these conclusions. For instance, Zhang et al. (2008) observed that changes to the institutional framework may increase production, increase capacity utilization, and decrease system losses through enhancing efficiency. Reforming Kenya's electrical industry to include the private sector in energy generation is a step in the right direction toward powering the nation. Pollitt (1997) praised the contribution of the private sector to the energy supply. To protect the interests of customers and the industry as a whole, he contends that this should only take place in the presence of a regulator. Contrarily, Boss (2013) notes that permitting competition in the business instead of strict rules bears more rewards.

Adopting a reform, however, is one thing; putting it into practice, however, is quite another. Evidence suggests that a number of issues may prevent reforms in policy from being implemented well, which would prevent them from serving the intended purpose (Kowsari, 2011). The most important aspects are those related to the economy and society, such as aptitude, behavior, cultural traits, and preference.

A qualitative interview with EPRA’s electricity officer revealed that the organization has the necessary capacity both in terms of finance and personnel to carry out its regulatory role which includes the establishment of standards in the energy sector. The standards are geared towards ensuring fair consumption, safety, and above all,

consumer protection. During the interview, the officer stated that EPRA does not get funding from the exchequer but from electricity levies, license fees, and development partners such as the World Bank, JICA, and GTZ, among others. Nevertheless, the regulator notes some institutions like Kenya Power and REREC are not well funded to carry out their mandate and hence, this is likely to affect the pace of electrification in the rural areas. This implies that a lack of capacity is likely to compromise the implementation of reforms and hence, lower the pace of rural electrification. However, the officer observed that:

> *Due to insufficient capacity in some of these institutions, we are promoting the use of energy sources to bridge the gap both in the generation and distribution of electricity. This includes the use of solar systems, mini-grids, fossil fuels, and wind power. The officer disclosed that because of this, access to electricity has been redefined to include connection to mini-grids and solar systems and not just electricity as it has been known traditionally. In addition, the study has learned that to effectively carry out their mandate, various policy frameworks have been developed. Such includes policies that touch on the use of solar power (solar grid regulations), and certification of electricity practitioners (wiring among others*).

4.6.1.2.2 Hypothesis Test

Finally, the study sought to test the hypothesis that:

H_{01}*: Institutional reforms have no significant effect on electricity access in rural Kenya;*

Spearman's rank technique was adopted to test the hypothesis whose results are presented in Table 4.21.

Table 4.21: Test for First Hypothesis

Number of obs	360
Spearman's rho	0.5033
Prob > t	0.0458

Findings indicate rejection of the null hypothesis given the P-value =0.0458), less than 0.05. Thus, the study concludes that there is a statistically significant relationship between institutional reforms and electricity access in rural Kenya. This is consistent with regression results.

4.6.2 The Effect of Governance Reforms on Rural Kenya's Access to Electricity

The second objective of the study investigate the effect of governance reforms on electricity access in rural areas. Both descriptive and inferential statistics are presented and discussed in this sub-section.

4.6.2.1 Descriptive Statistics

The study sought to evaluate various governance issues through a series of questions to the respondents. The study began by asking respondents whether REREC involves them in making decisions. According to the findings, most respondents, 147 (47.7% %) disagreed with only 5.2 % stating in the affirmative. In addition, 145 respondents representing 47.1 % were unaware. These results imply that generally, the majority of the rural households are not involved in decision-making by REREC.

In addition, the study enquired from the respondents where they take their complaints in case of challenges in accessing or utilization of electricity. Findings reveal that most of the complaints are reported to KP at 86% followed by REREC and EPRA at 1.1 % each. The rest of the respondents did not respond to this question. This implies that either most households are more familiar with KP than other institutions within the electricity sub-sector or most of the complaints fall within the performance of KP.

When asked about the availability of REREC offices in the locality, only 33 households representing 10.3% of those polled indicated yes, while 85 respondents accounting for 26.6% indicated no. Nevertheless, the majority of the households, 201(63%) indicated having no knowledge of the existence of REREC offices. These results imply that the presence of REREC in rural areas is not very visible. Furthermore, the households were required to indicate their level of agreement with the following statement related to governance issues in Kenya's electricity sub-sector using a Likert scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA). Table 4.22.

According to the statistics, the majority of the respondents were neutral on the assertion that Kenya Power (KP), REREC, and EPRA are very effective and efficient in their service delivery (mean=3.1472), KP efficiently provides electricity in rural areas (mean=3.1694), and incidences of power blackout determines access to electricity by rural households in Kenya (mean=2.9167). In addition, the study finds that respondents agreed with the statement that they like the level of response by KP with regard to power blackouts but, overall, the majority were neutral given a mean score of 2.8333, while on the question of whether there is adequate citizen participation in the governance of rural electrification projects to ensure successful completion, most households were undecided with a mean of 2.8556.

Table 4.22: Governance Reforms Summary Statistics

Construct (N=360)	Mean	Std. Deviation
Kenya Power (KP), REREC, EPRA are very effective and efficient in their service delivery;	3.14	.98
KP efficiently provides electricity in rural areas;	3.16	.97
Incidences of power blackout determines access to electricity by rural households in Kenya;	2.91	1.02
I like the level of response to power blackout by KPLC.	2.83	1.12
There is adequate citizen participation in governance of rural electrification projects to ensure successful completion;	2.85	1.05
EPRA has minimized incidences of corruption cases in the electricity sub-sector in Kenya;	2.98	.92
Participation of consumer organizations in the energy sector's reforms has had a considerable impact on electricity access in rural Kenya;	3.02	.90
Consumers are well represented in the Kenya's energy sector structure;	2.98	1.02
Management wrangles in the electricity sub-sector has affected electricity connectivity in rural Kenya;	3.25	1.02
Legal framework provides for participation of civil society groups such as consumer organization in legal reforms within the energy sector in Kenya;	3.12	.79
Decentralization of decision making from the ministry to EPRA has improved connectivity to electricity	3.22	.84
The establishment of Energy Regulatory Commission (an independent commission) has improved access to electricity in rural areas	3.23	.82
There is a framework for consumer interest representation such as redress mechanisms and a platform for effective consumer participation in regulatory reform process;	3.15	.79
The presence of consumer interest representation in EPRA has led to increased electricity demand in rural areas;	3.32	.81

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

Furthermore, the study indicates that most respondents remained neutral on the assertion that EPRA has minimized incidences of corruption cases in the electricity sub-sector in Kenya, and participation of consumer organizations in the energy sector's reforms has had a considerable impact on electricity access in rural Kenya with a means of 2.9806 and 3.02 respectively. Similarly, most households are neutral on the

arguments that consumers are well represented in Kenya's energy sector structure, management wrangles in the electricity sub-sector have affected electricity connectivity in rural Kenya, and the legal framework provides for the participation of civil society groups such as consumer organization in legal reforms within the energy sector in Kenya with the means of 2.98, 3.25 and 3.12 respectively.

The same findings were reported on the question of whether decentralization of decision-making from the ministry to EPRA has improved connectivity to electricity, whether the establishment of the Energy Regulatory Commission (an independent commission) has improved access to electricity in rural areas, and whether there is a framework for consumer interest representation such as redress mechanisms and a platform for effective consumer participation in the regulatory reform process. Finally, the majority of the households were neutral on the assertion of whether the presence of consumer interest representation in EPRA has led to increased electricity demand in rural areas.

4.6.2.2 Factor Analysis

The study adopted a factors analysis approach to extract factors from many variables of the Likert scale. To begin with, Table 4.23 displays the results of KMO for sample accuracy and Bartlett's test for Sphericity.

Table 4.23: KMO and Bartlett's Test on Governance Reforms

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.673
Bartlett's Test of Sphericity	Approx. Chi-Square	823.895
	df	55
	Sig.	.000

These results for KMO (0.673) confirm the accuracy of the sampling. In addition, a 0.000 p-value for Bartlett's test means that the test for Sphericity was significant.

Next, Table 4.24 presents the total variance output which shows that four factors were extracted from the factor analysis process. These five factors explain 63.261 variance. The remaining factors are insignificant.

Table 4.24: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.973	27.031	27.031	2.973	27.031	27.031	2.164	19.673	19.673
2	1.548	14.074	41.105	1.548	14.074	41.105	1.836	16.689	36.363
3	1.434	13.036	54.141	1.434	13.036	54.141	1.769	16.081	52.443
4	1.003	9.120	63.261	1.003	9.120	63.261	1.190	10.818	63.261
5	.915	8.319	71.580						
6	.765	6.958	78.538						
7	.634	5.766	84.304						
8	.530	4.814	89.119						
9	.451	4.104	93.222						
10	.413	3.754	96.976						
11	.333	3.024	100.000						

Extraction Method: Principal Component Analysis.

Finally, Table 4.25 presents a rotated component matrix which indicates that five variables were loaded on the first component, three on the second component, and three on the third component. In addition, component four was loaded with one variable. According to these results, the first factor (component) is related to beneficiary participation, the second factor is associated with accountability reforms, the third factor is related to decentralization and finally, the fourth factor relates to accountability.

Table 4.25: Governance Reforms Rotated Component Matrix

	Component			
	1	2	3	4
Kenya Power (KP), REREC, EPRA are very effective and efficient in their service delivery;		.853		
KP efficiently provides electricity in rural areas;		.758		
Incidences of power blackout determines access to electricity by rural households in Kenya;				.859
I like the level of response to power blackout by KPLC.	.660			
There is adequate citizen participation in governance of rural electrification projects to ensure successful completion;	.799			
EPRA has minimized incidences of corruption cases in the electricity sub-sector in Kenya;	.671			
Participation of consumer organizations in the energy sector's reforms has had a considerable impact on electricity access in rural Kenya;	.528			
Consumers are well represented in the Kenya's energy sector structure;	.501			
Decentralization of decision making from the ministry to EPRA has improved connectivity to electricity			.784	
The establishment of EPRA (an independent commission) has improved access to electricity in rural areas			.800	
The presence of consumer interest representation in EPRA has led to increased electricity demand in rural areas;			.543	

Extraction Method: Principal Component Analysis

4.6.2.3 Logistic Regression between Governance Reforms and Electricity Access

To conduct a regression analysis between access to electricity and governance reforms, the study constructed a composite variable between factors 2 and 4 which are related to accountability reforms. The study carried out a logistic regression where the access to electricity variable was regressed on governance reform variables. Table 4.26 presents Hosmer L-T for fitness results which indicates the model was well fit. This is attributed to insignificant Hosmer L-T test whose p-value is greater than 0.05.

Table 4.26: Hosmer-Lemeshow Test on Governance Reforms and Electricity Access

Hosmer and Lemeshow Test		
Chi-square	df	Sig.
7.067	8	.529

Next, Table 4.27 indicates the model summary. The findings for Cox & Snell R Square and Nagelkerke R Square show that the predictor variables (governance reforms) explain the explained variable (electricity access) by 0.043 and 0.059 respectively. This implies that governance reform indicators have a lower predictive explanatory power on electricity access in rural areas (Kenya).

Table 4.27: Model Summary on Governance Reforms and Electricity Access

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	463.334[a]	.043	.059

With regard to the classification table (Table 4.28), the results show an overall percentage of the probabilities of 62.8% which is greater than the cut value of 0.5 or 50%. This indicates a high level of accuracy and thus, the results can be relied on.

Table 4.28: Classification Table on Governance Reforms and Electricity Access

			Predicted access to electricity		
	Observed		no	yes	Percentage Correct
Step 1	access to electricity	no	192	26	88.1
		yes	107	33	23.6
	Overall Percentage				62.8

a. The cut value is .500

Finally, summary statistics which includes the coefficients, p-values and odd ratios are presented in Table 4.29.

Table 4.29: Logistic Regression Coefficients (Variables in the Equation)

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Participation	-.143	.113	1.600	1	.206	.867
Accountability	.346	.116	8.919	1	.003	1.413
Decentralization	.249	.112	4.947	1	.026	1.283
Constant	-.463	.111	17.343	1	.000	.629

Dependent variable: Access to electricity

The coefficient for participation indicates a negative relationship with electricity access in rural Kenya. Nevertheless, this variable is not statistically significant given a p-value of 0.2056, greater than 95% confidence interval. In addition, the odd ratio of 0.867, less than 1 is an indication that the probability of participation to influence access to electricity in rural areas is very low. These findings could be attributed to the fact that not many beneficiaries are involved in decision-making concerning the operations of the electricity sub-sector.

Qualitative interview with both REREC and EPRA officials on the issue of participation, reveals that there is no legal framework for conducting public participation but, this is done as a constitutional requirement. They noted that they conduct workshops in all counties whenever there is a need such as approval of tariffs, to get feedback from consumers or consumer organizations like COFEK. However, EPRA through its officer observes that the majority of the rural populace is ignorant of the regulatory policies or processes in the sector, and hence, getting feedback from consumers is difficult.

With regard to accountability, the study has established a positive and statistically significant effect (0.346, p-value=0.003). This implies that accountability, affects electricity connectivity in the rural areas of Kenya, positively. In addition, the odd ratio (1.413) indicates that a unit change in accountability has a chance of increasing electricity access in rural areas by about 1.413 times. In other words, accountability with the electricity energy sub-sector has a higher predictive power on electricity

access in rural areas. Accountability in the electricity sub-sector could increase the confidence of both investors and beneficiaries as well as other stakeholders, and hence, improve access to electricity. Brown and Mobarak (2012) observe that weak accountability within the electricity sub-sector institutions weakens the distribution of electricity to some groups and the allocation.

The positive impact of accountability could partly be explained by accountability measures in the electricity sub-sector. Qualitative interviews with KP, REREC, and EPRA have established that there are proper accountability mechanisms for all institutions within the energy sector. For instance, an interview with both EPRA and Kenya power officials reveals that their management and accounts are audited by the auditor general while their budgets have to be approved by the treasury. In addition, it was established that these mechanisms are very sufficient to ensure that the institutions are on top of their game.

Similarly, the study has found a positive relationship between decentralization and access to electricity in the rural areas. This is shown by the positive coefficient of 0.249 with a p-value of 0.026 which is less than 0.05. Additionally, the study has established an odd ratio of 1.283 indicating that the decentralization variables predict access to electricity highly. These results imply that the efforts made by the government to decentralize the electricity energy sub-sector through unbundling have a positive effect on electricity access in rural Kenya. Consistent with these findings is the study by Brown and Mobarak (2009) who found a positive relationship between decentralization of the power sector and access to electricity. In addition, Burke (2012) reports that dismantling monopolies in the power to allow private players brings competitiveness which leads to effectiveness with consumers as the final beneficiaries.

4.6.2.4 Hypothesis Test

Finally, the study sought to test the hypothesis that:

H_{02}: *Governance reforms have no significant effect on access to electricity in rural Kenya.*

Using Spearman's rank technique. The results of the test are presented in Table 4.30.

Table 4.30: Test for Second Hypothesis

Number of obs	360
Spearman's rho	0.6011
Prob > t	0.0010

Findings indicate a rejection of the null hypothesis given the P-value =0.0010), less than 0.05. Thus, the study concludes that there is a statistically significant relationship between government reforms and electricity access in rural Kenya. This is consistent with regression results.

4.6.3 The Effect of Service Delivery Reforms on Electricity Access in Rural Kenya.

The third objective of the study sought to examine the effect of service delivery reforms on electricity access in rural Kenya. This sub-section presents findings on a cooperative model, that is, Umeme Pamoja, and Stima loan schemes initiated by KP to promote access to electricity.

4.7.3.1 Descriptive Statistics

Concerning descriptive statistics, the study asked the households to indicate the alternative initiatives to promote access to electricity they knew about. Table 4.31 presents the results.

Table 4 31: Knowledge of Cooperative Schemes

Model	Frequency	Valid Percent
Umeme Pamoja	17	5.4
Stima Loans	68	21.5
others	2	.6
all	9	2.8
none	220	69.6
Total	**316**	**100.0**

The results show that most households, 220 (69.6%) have no knowledge of any cooperate model to finance their access to electricity. A total of 68 out of 316 households who responded to this question knew about the Stima loan while 17(5.4%) knew of Umeme Pamoja. In addition, 2.8% of those polled had knowledge of both Stima loans and Umeme Pamoja while 2(0.6%) were familiar with other schemes.

Next, the study enquired whether they had participated in any of these initiatives (models). The majority of the households, 240(92.3%) had not participated while only 20 households representing 7.7% had. These results mean that the uptake of these cooperative schemes was very low. Of 20 households who reported having enrolled in the schemes, 5 had participated in Umeme Pamoja while 15 were involved in Stima loans according to the findings.

Furthermore, the study sought to establish the amount of money that households had secured from the schemes. Table 4.32 indicates a mean amount of Kshs. 24, 870 with a standard deviation of Kshs. 16, 608, and these amounts ranged from a minimum of Kshs. 5, 000 and a maximum of Kshs. 60,000.

Table 4.32: Amount of Money Summary Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
How much money did you secure from the scheme?	20	5000.00	60000.00	24870	16608.607

Source: Author (2020)

Nevertheless, most respondents, 12 argued that this amount was not sufficient to cover electrification costs. These imply that they had to rely on other sources of finance to fill up the gap. The next sub-section analyses inferential statistics between access to electricity and participation in service delivery reforms.

4.6.3.1.1 Multinomial Logistic Regression

To investigate how service delivery reforms, affect electricity access in rural Kenya, the study conducted multinomial logistic regression. This was informed by the categorical nature of the independent variable, service delivery reforms where households were asked to indicate which incentive initiative, they had participated in. They were to choose among Umeme Pamoja, Stima loans, others, or all.

The first output of the regression was a case processing summary as presented in Table 4.33.

Table 4.33: Case Processing Summary

		N	Marginal Percentage
access to electricity	No	98	56.3%
	Yes	76	43.7%
In which initiative?	Umeme Pamoja	5	2.9%
	Stima loans	17	9.8%
	None	148	85.1%
	Others	4	2.3%
Valid		174	100.0%
Missing		186	
Total		**360**	

Table 4.33 shows that number of responses (N) in each response category alongside marginal percentages which indicate the proportion of valid observations found in each of the outcome variable (electricity access) groups. Subpopulation refers to a combination of independent variables specified for the model.

The model was well-fitted, as shown by Table 4.34's statistics on model fitting, which show that the p-value of 0.007, which is less than 0.05, indicates that the model is good. By rejecting the null hypothesis that all of the regression coefficients in the model are equal to zero, it is implied that at least one regression coefficient in the model is not equal to zero.

Table 4.34: Model Fitting Information

	Model Fitting Criteria	Likelihood Ratio Tests		
Model	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**
Intercept Only	24.400			
Final	12.291	12.109	3	.007

Table 4.35 on Pseudo-R-Square statistics for Cox & Snell, Nagelkerke, and McFadden indicates that the predictor variables (service delivery reforms) have less predictive power than the explanatory variables (electricity access).

Table 4.35: Pseudo R-Square

Cox and Snell	.067
Nagelkerke	.090
McFadden	.051

Finally, the study presents parameter estimates in Table 4.36.

Table 4.36: Parameter Estimates

Access to electricity		**B**	**Std. Error**	**Wald**	**df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
no	Intercept	.000	1.000	.000	1	1.000			
	Umeme Pamoja	.405	1.354	.090	1	.765	1.500	.106	21.312
	Stima Loans	1.540	1.185	1.689	1	.194	.214	.021	2.187
	Others	.439	1.014	.188	1	.665	1.552	.213	11.324

a. The reference category is: yes.

Despite the positive effect of these coefficients, the p-values are greater than, 0.05. This implies that the results are not statistically significant. Nevertheless, the odd ratios indicate that Umeme Pamoja has a higher probability (1.5) of enhancing electricity access in rural Kenya than Stima loans which have a lower probability (0.214). These

results were attributed to poor uptake of these service delivery reforms as demonstrated by a few households who indicated having knowledge of utilizing these services.

An interview with EPRA officials revealed that the uptake of cooperate schemes such as Umeme Pamoja, Stima loans, and revolving funds among others, is very low as most rural households think that it is the government's responsibility to supply electricity to them. He noted that:

> *If you enroll households with that mentality into these schemes, they will refuse to pay and this could lead to difficulties in the implementation.*

These findings imply that even though these schemes were initiated with an intention of enhancing electrification particularly in the rural areas, there is a challenge in terms of their uptake. These finding concurs with Namwakira et al (2017) who identified inadequacy of Stima loans and the high administration fees as a major constraint in its uptake. It appears that majority of the rural people have not been sensitized on these schemes and this has led to no significant effect on access to electricity in rural Kenya.

4.7.3.1.2 Hypothesis Test

Finally, the study sought to test the hypothesis that:

$H_{03:}$ *Service delivery reforms have no significant effect on access to electricity in rural Kenya.*

Using Spearman's rank technique. The results of the test are presented in Table 4.37.

Table 4.37: Test for Third Hypothesis

Number of obs	360
Spearman's rho	0.435
Prob > t	0.2310

The findings indicate acceptance of the null hypothesis given the P-value =0.2310), greater than 0.05. Thus, the study concluded that there is no statistically significant relationship between service delivery reforms and electricity access in rural Kenya. This is consistent with regression results.

4.6.4 The Extent to which Socio-Economic Factors, Political and Alternative Power Sources Intervene in the Effect of Regulatory Reforms on the Access to Electricity in Rural Kenya

The fourth objective of the study sought to investigate the extent to which socio-economic, political and alternative power sources intervene in the effect of regulatory reforms on the access to electricity in rural Kenya. This section begins with the discussion of descriptive statistics followed by inferential.

To begin with, the study sought to find out if the respondents had other alternative power sources apart from electricity. Majority of the households, 224 (92.9%) indicated yes to this question, while 14(5.8%) had no other alternative sources of power. These findings imply that most households in the rural areas have other alternative power sources.

Next, households with alternative power sources were asked to indicate whether they have selected alternative power sources. Table 4.38 presents summary results.

Table 4.38: Alternative Power Sources

Power source	Yes	No
Kerosene	179	128
Pressurized lamp	15	290
Candles	55	251
Torch	98	208
Fire wood	241	66
Solar lumps	181	125
Others	5	292

The statistics show that kerosene, firewood, and solar lumps are the major alternative power sources found in Kenya's rural homes. While firewood is normally used for cooking, rural households use solar lumps and kerosene for lighting.

Whether the respondents used alternative energy sources was another goal of the study. Results from Table 4.39 show majority of the households, 258(74.4%) do not use alternative power sources, with only 25.6% of those interviewed indicating that they use alternative power sources.

Table 4.39: Alternative Power Sources and Electricity Access

	Frequency	Percent
Yes	89	25.6
No	258	74.4
Total	**347**	**100.0**

Furthermore, the study sought to establish respondent's level of agreement with the following statements related to alternative power sources (see Table 4.40) using Likert scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Table 4.40: Alternative Power Sources Summary Statistics

Construct	Mean	Std. Deviation
The alternative sources of energy available in this community are cheaper than the cost of connecting to the national grid.	3.36	1.27
The alternative sources of energy are more reliable than electric energy.	2.96	1.25
The type of power source you use depends on your level of income.	3.67	1.14
You prefer alternative sources of energy to electricity.	2.98	1.41

Mean Strongly Disagree=1-1.4, Disagree=1.5-2.4, Neutral=2.5-3.4 Agree=3.5.4-4, Strongly Agree=4.5-5

Majority of the respondents were neutral with a mean of 3.36 to the assertion that alternative sources of energy available in this community are cheaper than the cost of connecting to the national grid. Similar findings are reported with regard to the argument that alternative sources of energy are more reliable than electric energy with a mean of 2.96 as well as the assertion that they prefer alternative sources of energy to electricity (2.98). Nevertheless, most households agreed to the statement that the type of power source used depends on the level of income with a mean of 3.67.

Moreover, the study sought to establish various political factors which have an influence on the access to electricity in rural areas. First, respondents were asked to indicate whether politics affects access to electricity. Majority of the households, 141(40.4%) indicated yes, while 104(29.8%) were of a contrary opinion. In addition, 104 (29.8%) of the households were indifferent on this question.

Next, the sought to establish whether politics should ideally influence access to electricity. Most respondents (46.8%) indicated that politics should not influence access to electrify while 105(30.2%) said that politics should influence access to electricity. Further findings show that, 80(23%) of the respondents were undecided on this question.

On the question of whether politics interferes with rural electrification projects, majority of the households interviewed disagreed (71.9%) while 90(27.5%) indicated yes. Only 2 respondents representing 0.6% of those interviewed were indifferent on this question. These findings imply that generally, political factors do not interfere with electrification of rural Kenya. Nevertheless, Brown and Mobarak (2012) reported that a weak political accountability for electricity means distribution of electricity to certain groups as well as allocation of subsidies are used for political advantage. Similarly, Golden and Min (2012); Oda and Tsujita, (2012) argued that distribution of electricity especially in developing countries is largely influenced by politicians to their advantage. A qualitative interview with REREC officer reveals that members of parliament have a great influence in the electricity sub-sector through their role in budgetary allocations. In addition, through their power, they sometimes influence

transformer allocation. The differential electrification rates in Kenya can be attributed to this fact.

4.6.4.1 Regression Analysis

To look at the degree to which alternative power sources, politics, and socioeconomic factors affect how well people can get electricity after regulatory changes. The study captures intervening variables through logistic regression analysis between the variables relating to access to power and regulatory reforms.

4.6.4.1.1 Effect of Household Head Age Intervention

The study sought to establish how age as an intervening variable on regulatory reforms affect access to electricity in rural Kenya. The study begins by presenting results for institutional reforms. The first output of the analysis is the summary results on Hosmer and Lemeshow test (see Table 4.41). The table show that the results of the test are insignificant, meaning, the model is well fit.

Table 4.41: Hosmer and Lemeshow Test

Hosmer and Lemeshow Test		
Chi-square	**df**	**Sig.**
10.360	8	.241

The model summary results (Table 4.42) indicate that regulatory reform variables capturing age of the household age, weakly explain access to electricity as by the coefficients of Cox & Snell R square (0.04), and Nagelkerke R square (0.054).

Table 4.42: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	450.417[a]	.040	.054

According to the classification Table, the overall percentage of the probabilities is 61%, greater that the cut value of 0.5 or 50% (Table 4.43). This shows high level of accuracy of the model with regard to predicting the effect of regulatory reforms on electricity access with age as an intervening variable.

Table 4.43: Classification Table

			Predicted		
			access to electricity		Percentage
	Observed		No	Yes	Correct
Step 1	access to electricity	No	189	20	90.4
		Yes	115	22	16.1
	Overall Percentage				61.0

a. The cut value is .500

The estimated coefficients, p-values and odd ratios are presented in Table 4.44.

Table 4.44: Logistic Regression Results (Variables in the Equation)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	institutional	.622	.321	3.754	1	.053	1.863
	Governance	.640	.328	3.812	1	.051	.527
Step 2[a]	Service delivery	.405	1.354	.090	1	.765	1.500
	Age-institutional	-.009	.008	1.248	1	.264	.992
	Age-governance	.013	.008	2.974	1	.085	1.013
	Age-servicedel	.002	.003	.783	1	.376	1.002
	Constant	-.446	.112	15.726	1	.000	.640

The estimated results with regard to institutional reforms indicate that the interaction of age variable with institutional reforms does not have an effect. This is because, while the variable without age is significant at 10%, the interaction of the variable with age produces insignificant results. In terms of odd ratio, it can also be observed that the variable without age factor has a higher ratio (1.8663) as compared the variable with an interaction variable (age). These imply that the household head's age is not a

significant influencing factor when determining whether or not a person has access to electricity.

With governance, the study has established that the two variables are significant at 10% interval for the two variables (the variable with and the one without an interaction variable). Nevertheless, when it comes to the odd ratios, an interaction variable indicates relatively higher probability of a change in the outcome variable as compared to the variable without an interaction variable. These results means that, age as an interaction variable has a slight impact on the effect of governance reforms on access to electricity. These results imply that household heads with many years, have a relatively better understanding on the effect of governance reforms on electricity access.

Finally, the study fails to find significant results with regard to service delivery reforms given p-values which are greater than alpha at all levels of significance. These results imply that age of the household head is not a significant factor of intervention between service delivery reforms and access to electricity.

4.6.4.1.2 Effect of Alternative Power Sources Intervention

Next, the study sought to investigate the effect of alternative power sources as an intervening variable between regulatory reforms in the electricity-energy sub-sector and electricity access in the rural areas. A regression analysis was contacted between electricity access and regulatory reforms with an interaction variable, alternative power sources. Table 4.45 presents results for model fitness.

The Hosmer and Lemeshow test result are insignificant given the p-value of 0.380. This imply that, the model was well fitted following Hosmer and Lemeshow (2000).

Table 4.45: Hosmer and Lemeshow Test

Hosmer and Lemeshow Test		
Chi-square	**df**	**Sig.**
8.563	8	.380

The model summary results (Table 4.46) indicate that regulatory reform variables capturing alternative power sources, weakly explain access to electricity as by the coefficients of Cox & Snell R square (0.029), and Nagelkerke R square (0.039).

Table 4.46: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	467.562[a]	.029	.039

The classification Table indicates that, the overall percentage of correctly predicted cases 64.3%, greater that the cut value of 0.5 or 50% (Table 4.47). This shows high level of accuracy of the model with regard to predicting the effect of regulatory reforms on electricity access with alternative power sources as an intervening variable.

Table 4.47: Classification Table

			Predicted		
			Access to electricity		Percentage
	Observed		No	Yes	Correct
Step 1	access to electricity	No	206	9	95.8
		Yes	118	23	16.3
	Overall Percentage				64.3

a. The cut value is .500

The estimated coefficients, p-values and odd ratios are presented in Table 4.48.Table 4.48: Logistic Regression Results (Variables in the Equation)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	institutional	.321	.114	7.957	1	.005	1.379
	Governance	.151	.065	5.481	1	.019	1.163
	Service delivery	.499	.213	5.506	1	.019	.607
Step 2[a]	Alterp-institutional	-.179	.114	2.475	1	.116	.836
	Alternp-governance	-.052	.059	.781	1	.377	.950
	Alternp-servicedel	-.134	.046	8.341	1	.004	.875
	Constant	-.415	.111	14.087	1	.000	.660

The results concerning institutional reforms indicate that with alternative power sources, the coefficient changes from positive to negative. This means that alternative power sources could water down the effect of institutional reforms on access to electricity in rural Kenya. Nevertheless, the interaction variable is not statistically significant given the p-value of 0.116. In addition, the odd ratio for interaction variable with regard to institutional reforms is lower (0.836) as compared to the one without an interaction variable (01.379). This imply that even though alternative power sources might have adverse effect on the ability of the institutional reforms to influence access to electricity, the probability of this effect is much lower.

With regard to governance, the study has also established similar results where the sign of the coefficient turns from positive to negative. In addition, the coefficient for the interaction variable is not statistically significant. Furthermore, the odd ratio for the interaction variable is much lower (0.950) in comparison to the governance reform variable without interaction variable (1.163). These findings can be interpreted to mean that the probability of alternative power sources to influence the effect of governance reforms of electricity access is much lower.

Concerning service delivery reforms, the study has established that alternative power sources have an adverse influence on service delivery reforms on their effect on electricity access in rural Kenya. This is demonstrated by the change in the sign of the coefficient from positive (0.499) without interaction variable, to negative (-0.134) with their p-values of 0.019 and 0.004 respectively. In addition, the odd ratio of an interaction variable (0.875) is relatively higher than that without interaction variable (0.607).

Newbery (2004) reported that availability and affordability of alternative power sources could affect access to electricity especially in rural areas. The study noted that there are numerous energy sources in rural areas such as biomass, fire wood among others and hence, this are likely to reduce the demand for electricity which is costly in comparison with alternative sources.

4.6.4.1.3 Effect of Income Intervention

Finally, the study examines the effect of income as an intervening variable between regulatory reforms in the electricity-energy sub-sector and electricity access in the rural areas. Table 4.49 presents Hosmer and Lemeshow test results for model fitness. With p-value of 0.327, the study concludes that the model was well fitted.

Table 4.49: Hosmer and Lemeshow Test

Hosmer and Lemeshow Test		
Chi-square	**df**	**Sig.**
9.184	8	.327

The model summary results (Table 4.50) indicate that regulatory reform variables capturing household income, weakly explain access to electricity as by the coefficients of Cox & Snell R square (0.040), and Nagelkerke R square (0.054).

Table 4.50: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	242.609[a]	.040	.054

The classification Table show that, the overall percentage of correctly predicted cases 58.8%, greater that the cut value of 0.5 or 50% (table 4.51). This shows that the model was accurate, and hence, its results can be relied on.

Table 4.51: Classification Table

			Predicted		
			access to electricity		Percentage
	Observed		No	Yes	Correct
Step 1	access to electricity	No	87	14	86.1
		Yes	61	20	24.7
	Overall Percentage				58.8

a. The cut value is .500

Finally, Table 4.52 presents the coefficients, p-values and odd ratios.

Table 4.52: Logistic Regression Results (Variables in the Equation)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	institutional	.658	.256	6.588	1	.010	1.931
	Governance	.135	.143	.890	1	.346	.874
	Service delivery	-.470	.267	3.094	1	.079	.625
Step 2[a]	incominstitutional	.020	.013	3.163	1	.075	1.000
	incomgovernance	.100	.008	4.516	1	.034	1.014
	incomservicedel	.001	.030	5.137	1	.023	1.100
	Constant	-.204	.153	1.784	1	.182	.815

The study reveals that income does not have an influence on the relationship between institutional reforms and access to electricity in rural Kenya. This is shown by the odd ratio of 1.000 associated with the interaction variable. In addition, the interaction variable is only significant at 10% level. Nevertheless, the results indicate that household income influences the relationship between governance reforms and access to electricity in rural Kenya given a positive coefficient and a p-value of 0.034 with an odd ratio of 1. 014. Finally, the odd ratio (1.100) for an interaction variable of service delivery reforms indicates that income has an influence of service delivery reforms towards access to electricity in rural Kenya.

Other studies have established similar results. For instance, Burke, (2012) established that demand for electricity has a direct relationship with electricity access in rural areas especially in developing countries. In addition, Onuonga (2008) observes that high

poverty levels in developing countries have constrained demand for electricity. This imply that reforms in the electricity sub-sector alone cannot increase access to electricity but, the economic status of the economy as well.

4.8 Overall Regression Equation

In this sub-section, the study presents overall regression results on the effect regulatory reforms in the electricity energy sub-sector and their effect on access to electricity in rural areas of Kenya

The first output of the regression is the Hosmer-Lemeshow Test for the model fitness presented in Table 4.53.

Table 4.53: Hosmer-Lemeshow Test

Hosmer and Lemeshow Test		
Chi-square	**Df**	**Sig.**
4.345	8	.543

With the Chi-square statistic of 4.345 and p-value of 0.543, greater than 0.05, it means that the overall model is statistically insignificant, and hence, well fitted.

Next, Table 4.54 presents model summary results with Cox & Snell R Square and Nagelkerke R Square. These values indicate the independent variables predict the dependent variable by about 5%-a less predictive power.

Table 4.54: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	563.956[a]	.049	.062

The classification table (Table 4.55) shows the cross-classifying of the outcome (dichotomous) variable whose values are obtained to estimated logistic probabilities. Findings from 4.72 show an overall percentage of the probabilities of 56.4% is greater that the cut value of 0.5 or 50%. This indicates a high level of accuracy.

Table 4.55: Classification Table

			Predicted		
			access to electricity		Percentage
	Observed		No	Yes	Correct
Step 1	Access to electricity	No	193	22	89.8
		Yes	111	30	21.3
	Overall Percentage				56.4

a. The cut value is .500

The final output contains the logistic regression results with estimated coefficients whose results are presented in Table 4.56.

Table 4.56: Overall Logistic Regression Coefficients (Variables in the Equation)

	B	S.E.	Wald	df	Sig.	Exp(B)
Subsidies	.417	.103	8.833	1	.000	1.563
Legal reforms	.325	.103	5.890	1	.004	1.345
Energy Fund	.062	.111	.000	1	.284	1.010
Participation	-.231	.163	1.800	1	.316	.467
Accountability	.460	.124	8.919	1	.001	1.513
Decentralization	.340	.172	6.137	1	.034	1.373
Umeme Pamoja	.105	1.234	.290	1	.635	1.700
Stima Loans	.540	1.345	1.329	1	.344	.214
Constant	.339	.231	8.663	1	.000	.545

Dependent variable: Access to electricity

The overall results indicate that the indicators of institutional reforms are positive and statistically significant for access to electricity. This is indicated by the positive coefficients of 0.417 with a p-value of 0.000 and 0.325 with a p-value of 0.004 for subsidies and legal reforms respectively. In addition, the odd ratios for these two coefficients of 1.563 and 1.345 respectively show that subsidies and legal reforms have a higher probability of increasing rural electrification in Kenya. Generally, these findings imply that institutional reforms in the electricity energy sub-sector have a positive effect on electricity access in rural areas.

The majority of the rural people in Kenya have meager earnings and therefore any favorable tariff that is informed by tax rates is deemed favorable to them and thus, has a higher probability of increasing the chances of connectivity to electricity. In addition, any form of subsidy in relation to connectivity or power bills is likely to lead to more access to electricity in rural Kenya. A study by KIPPRA (2009) observed that when the government reduced value-added tax by 4 percent in 2007, there was an increase in the utilization of electricity across the country. Similarly, Brown et al. (2006) for Tanzania and Holmes (2003) for Zimbabwe, found that the best way to enhance rural electrification is to reduce electricity prices through subsidies. In addition, the dismantling of monopolies in the electricity energy sub-power sector to allow for competition has been linked to efficiency and hence more uptake of electricity according to Brown and Mobarak (2009).

With regard to governance reforms, the study has established a positive and statistically significant relationship between accountability, decentralization, and access to electricity in rural areas. This is demonstrated by the positive coefficients of 0.460 (p-value=0.001) and 0.340 (p-value=0.034) for accountability and decentralization respectively. These statistics imply that accountability and decentralization measures undertaken by the Kenyan government have a positive impact on rural electrification. With the odd ratios of more than 1, the study shows that governance reforms with respect to accountability and decentralization of the electricity energy sub-sector have a higher probability of enhancing electricity access in rural Kenya.

Consistent with these findings is the study by Barnes (2011) who reported that the establishment of independent regulators in an industry brings accountability, transparency, efficiency, and effective service delivery which is likely to enhance not only use but, access to electricity as well. Similarly, Barnes observed that the centralized energy sector hinders access to electricity among the underprivileged population. Indeed, the aim of changing legislation that established monopolies over power supply in Kenya was aimed at facilitating rural electrification (KIPPRA, 2007).

However, the study failed to demonstrate a statistical relationship between participation and access to electricity given a p-value of 0.316, greater than 0.05. This could be attributed to low or poor involvement of the public (potential consumers, consumers, civil society) in matters of electrification as demonstrated in the descriptive statistics. In addition, an in-depth interview with an EPRA officer revealed that most households in rural areas are ignorant of the policies in the electricity sub-sector and hence, they don't get the needed feedback to improve their services for good outcomes.

Concerning service delivery reform indicators, the study has failed to establish their relationship with access to electricity. Though the coefficients for Umeme Pamoja and Stima Loans are positive, they are not significant given that their p-values are greater than 0.05. Nevertheless, the odd ratio for Umeme Pamoja shows that it has a higher probability of enhancing electricity access in rural areas. These results can be attributed to the fact that not many rural people are ignorant of these reforms and hence, low uptake. In addition, the interview with EPRA officials reveals that a section of the rural population has a perception that it is the role of the government to connect them to electricity. This could have contributed to their low enrollment in these financing schemes. For instance, the officer noted that:

> *If you enroll households with that mentality into these schemes, they will refuse to pay and this could lead to difficulties in the implementation.*

An in-depth interview with EPRA, REREC, and KPLC officials revealed several challenges that could be attributed to the low pace of electrification in rural Kenya. Key among such challenges is the cost of electricity in the country. For instance, when asked why electricity bills in Kenya are very high as compared to other countries in the region, an EPRA officer defended this by explaining:

> *It is true that power bills are relatively lower in Tanzania and Ethiopia but, in these countries, the governments have subsidized their bills. The danger of subsidizing electricity bills is that it discourages the participation of independent power producers or suppliers and hence, chokes private investment in the sector.*

In addition, the EPRRA and REREC officials admitted that among the key challenges affecting their delivery is poor public participation which is attributed to the ignorance of most households on policies in the industry. It therefore becomes difficult to get feedback on how to enhance their regulations and hence, performance. In addition, the study has revealed that the power sector is not growing as expected. For instance, the officer noted that:

> *The electricity demand is not in tandem with consumption, a situation which puts pressure on the cost in order to scale up infrastructure.*

Nevertheless, the study has established that the sector is addressing this challenge by encouraging alternative power sources such as solar systems, and fossil fuels among others to ensure that electricity bills do not skyrocket.

On the question of accountability, the study established that there are proper accountability mechanisms for all institutions within the energy sector. For instance, an interview with both EPRA and Kenya power officials reveals that their management and accounts are audited by the auditor general while their budgets have to be approved by the treasury. In addition, it was established that these mechanisms are very sufficient to ensure that the institutions are on top of their game.

Nevertheless, some conflict does occur in the industry which affects the performance. For instance, an interview with an EPRA official discovered that there are some overlapping roles among the institutions in the electricity sub-sector. For example, the study established that the National Construction Authority tries to license electrical works in the construction which is a mandate of EPRA. In addition, the study reveals that the determination of tariffs for mini-grids brings a conflict between EPRA and Kenya's power. The EPRA official stated that:

> *When EPRA wants to determine the tariffs for people working on mini-grids, KP complains that we are encroaching into their territories.*

These kinds of conflicts are likely to derail the electrification across the country. Furthermore, the study has established the existence of conflict between consumers and power generators. A qualitative interview with a REREC official indicates that power producers may want to scale up their production because consumer demand could be shrinking hence, making it difficult to balance between demand and supply. The officer noted that:

> *If the producers have put in more investment, and there is less consumption, the cost of electricity could automatically go up.*

Nevertheless, EPRA officials noted that they try to mitigate the conflict between consumers and power producers using the trends in GDP. The study reports that a growing economy indicates increased demand for electricity and therefore, this is considered in the setting of tariffs. Other measures employed by the regulator in addressing other conflicts include tribunals and mediations.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary, conclusions, and recommendations. The study also suggests additional research. It is based on the results of the study in chapter four

5.2 Summary of Findings

The study's goal was to assess the effect of regulatory reforms in Kenya's electricity energy sub-sector on access to grid electricity in rural Kenya. The following four specific goals were established: to assess the effect of institutional reforms on electricity access in rural Kenya; to determine the effect of governance reforms on electricity access in rural Kenya; to assess the impact of service delivery reforms on electricity access in rural Kenya; and to assess the degree to which socio-economic, political, and alternative power sources influence the effect of regulatory reforms on electricity access in rural Kenya. In Kakamega, Nyandarua, and Uasin Gishu counties, primary data collection was done through household surveys and key informant interviews. A reliability assessment using Cronbach's alpha was used before data analysis to confirm that the Likert scale items were reliable. To guarantee the accuracy of the data-gathering instruments, a pilot study and expert opinion were used. In collecting the data, summary, descriptive, and inferential statistics were used. This section's subsection contains a summary of the findings.

Turning to summary statistics, the study established that the majority of the respondents have a primary certificate as their highest level of education. In addition, most household heads are unemployed followed by those with self-employment. On electricity access, the study shows that 39.6 percent of the households had connected to the national grid against 60.4 percent with no access to electricity. Among the three counties surveyed, Kakamega County has the lowest electrification rate (25.85%) followed by Nyandarua (39.4%) while Uasin Gishu has the highest rate (65.82%).

Crosstabulation of the results indicates that male household heads were more likely to connect to the national grid than their female counterparts. In addition, household heads who are employed or are in self-employment are more likely to get access to electricity. Furthermore, summary findings show that access to electricity is associated with the household head level of education in rural Kenya. The rest of this section presents summary findings based on study objectives.

5.2.1 Institutional Reforms and Access to Electricity

The first goal was to examine how institutional improvements in Kenya have impacted people's access to energy. The majority of rural Kenyan households, according to descriptive data, have little awareness of institutional reforms such as the legal system, subsidies, taxes, and the energy fund. The study also found that connectivity fees and electricity prices had an impact on rural communities' access to electricity.

Logistic regression findings indicated a positive and statistically significant relationship between subsidy reforms and access to electricity. This was attributed to electricity subsidies in Kenya. Similar results are observed with respect to the coefficient of legal reforms. The odd ratios show that subsidies and legal reforms have a higher probability of influencing electrification in rural Kenya. Nevertheless, the study could not establish statistically significant findings with respect to energy funds. This could be linked to the fact that most households in rural areas are not aware of the existence of energy funds.

5.2.2 Governance Reforms and Access to Electricity

The second objective was to establish the effect of governance reforms on access to electricity in rural Kenya. Descriptive statistics show that most households disagreed that they were involved by REREC in rural electrification programs. In fact, the majority of the respondents reported that they were not aware of REREC’s existence or even where their offices are. In addition, the majority of the respondents remained neutral on the question of whether they are involved in governance in the electricity sub-sector. Similarly, most respondents were neutral on whether electricity institutions (KP, EPRA, and REREC) were effective in electrification. Nevertheless, the

households were of the view that the participation of consumer organizations affects rural electrification.

Turning to regression analysis, the study established that accountability had a positive effect on access to electricity in rural Kenya. Transparency and openness in the management of the electricity sub-sector could lead to more electrification. Similarly, there was a positive relationship between decentralization of the power sector and access to electricity in rural areas. The odd ratios of accountability and decentralization variables were more than 1 indicating that the two factors have a higher probability of enhancing access to electricity in Kenya. The study could not establish statistically significant results with respect to citizen participation. This could be attributed to the reported limited participation of the rural population in the governance of the electricity sub-sector.

5.2.3 Service Delivery Reforms and Access to Electricity

The third objective sought to determine the effect of service delivery reforms on access to electricity in Kenya. The majority (69.6%), according to descriptive statistics, are unaware of the service delivery improvements in the power subsector. This implies that most households in rural Kenya have no knowledge of cooperative schemes such as Umeme Pamoja and Stima loans whose aim was to enhance access to electricity. In addition, the study established that most households interviewed (92.3%) did not participate in these cooperative schemes, that is, there is a low uptake of cooperative schemes.

The multinomial logistic regression has established a positive relationship between service delivery reforms and access to electricity but, the coefficients were not statistically significant. This was attributed to low levels of participation in the cooperative model schemes. Notwithstanding, since the odd ratio of Umeme pamoja is greater than 1, this implies that it has a higher probability of enhancing access to electricity in rural areas.

5.2.4 Socio-Economic, Political, Alternative Power Sources and Access to Electricity

The fourth objective of the study was to establish the extent to which socio-economic, political, and alternative power sources intervene in the effect of regulatory reforms on access to electricity in rural Kenya. Descriptive statistics show that most households in the study area had alternative power sources such as solar and Kerosene lamps and firewood. In addition, most respondents were of the view that politics influenced access to electricity in rural areas. On socioeconomic factors, findings indicate that male-headed households, higher education of the household head, and income were associated with access to electricity.

Logistic regression analysis for the age of a household head affected how governance reforms influence access to electricity in rural Kenya. Experience to understand governance reforms increases with age as explained by these findings. In addition, the study established that age affects how service delivery reforms affect access to electricity. Alternative power sources have a negative effect on how service delivery reforms influence access to electricity. Finally, the study also reported that the income of the household affects the way in which regulatory reforms influence access to electricity.

5.3 Conclusion

The study's findings were used to make a variety of conclusions. First, the study found that rural households in Kenya have little knowledge of the institutional reforms in the electricity sub-sector (taxes, subsidies, and energy funds). Additionally, the cost of connectivity and electricity bills affect rural communities' access to electricity. Furthermore, it was deduced that changes to taxes, subsidies, and laws within the electricity energy sub-sector have a favorable impact on rural Kenyans' access to power.

Secondly, the study concludes that there is low participation of households in the rural areas in electrification programs undertaken by REREC. In addition, most households in rural Kenya are not aware of REREC or even where their offices are. Furthermore,

the study concludes that accountability and decentralization of the electricity sub-sector have a positive influence on electricity access in rural areas.

Thirdly, the study concludes that the majority of households in rural Kenya are neither aware of service delivery reforms nor utilize those reforms to enhance electricity connectivity. In addition, the study concluded that even though the coefficient for Umeme Pamoja was not found to be statistically significant, its odd ratio indicated that this delivery reform can enhance access to electricity in rural areas.

Fourthly, the study finds that politics affect the availability of electricity in Kenya's rural communities. Additionally, it has been determined that access to electricity is influenced by household head age, income, and educational attainment. Alternative energy sources also affect rural Kenya's ability to receive electricity.

5.4 Recommendations

From the summary and conclusion of the findings, the following recommendations are suggested:

1. The government should make 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 the existence of energy funds could help to increase electrification in rural areas.
2. The government should maintain the current subsidies or even review taxes downward to encourage rural electrification.
3. To enhance access to electricity in rural areas, the government through Kenya Power should raise the level of awareness on service delivery reforms such as Umeme Pamoja and Stima loans.
4. REREC should provide a platform that encourages rural households to participate in electrification programs.

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APPENDICES

Appendix I: Household Questionnaire

Hello. My name is **Milton Alwanga,** a student at Jomo Kenyatta University of Agriculture and Technology (JKUAT) pursuing Doctor of Philosophy degree in Development Studies. I am conducting an academic study on the effects of regulatory reforms in the electricity energy subsector on access to electricity in rural Kenya**.** The findings will be used to generate a report which could be used by the government and other agencies in the electricity energy sub-sector to enhance rural electrification in Kenya. The questionnaire will take about 30 minutes. All the answers you give will be confidential and your participation is completely voluntary. However, I hope you will participate since your views are important in the success of this study.

Enumerator's name_____Date of interview___ /___/2018

Starting time: ____: _____ Household no_____

No	Variable label	Variables
1.	County	
2.	Division	
3.	Location	
4.	Sub-location and village	
5.	Phone number	

Part A: Socio-Economic Characteristics

6	Name of the respondent (optional)	…….
7	Gender of the household head	a). Male [ ] b). Female [ ]
8	Relationship to the Household Head *(tick)*	a). Head [ ] b). Spouse [ ] c). Son/daughter [ ] d). Grandchild [ ] e). Others (specify)…….. [ ]
9	Age (years)	a). 20 [ ] b). 25 [ ] d) .25 [ ]

		d). 30 [ ] e).35 [ ] f). 40 [ ] g).45 [ ] h).50 [ ] i). Others(Specify)…… [ ]
10	Marital Status *(tick)*	a). Married [ ] b). Divorced/Separated [ ] c). Widowed [ ] d). Single [ ]
11	Level/Number of years of schooling	a). 0 (no formal education) [ ] b). 8(Primary) [ ] c). 12 (Secondary) [ ] d). > 12 (Tertiary) [ ]
12	Main occupation of the household head	A. Formal Employment [ ] B. Self-employed [ ] C. Daily laborer [ ] D. Unemployed [ ] E. Others (specify)……[ ]
13	What is your family's average monthly income (Kshs)?	……

Part B: Access to Electricity in Rural Kenya

14. Household connected to the nation grid (electricity)? A=Yes [ ] B=No [ ] (Observe)

15. If No, please explain……

16. If Yes, explain the reasons for getting connected……

17. How did you get to know about electricity connection procedures?

a). Through Community leaders [ ] d). Media, [ ]

b). REA, KPLC officials [ ] e). Others (specify) []

c). Community members [ ]

18. How did you finance your electricity connection?

a). Personal savings [ ] c). Others (specify) [ ]…

b). Loan [ ]

19. what was the amount you secured? ----------

20Would you consider the above (q 18) the best option?

A=Yes [ ] B=No [ ] C= Don't know [ ]…….

21. Please explain your response to question 19…….

22. Do you think the government is doing enough to facilitate access to electricity?

A=Yes [ ] B=No [ ]

23. Please explain your answer (q 21) ……

Part C: Institutional Reforms

24. Are you aware of the taxes charged on electricity?

A=Yes [ ] B=No [ ] C= Don't know [ ]…….

25. If yes, do you think these taxes affect access to electricity?.....

……

26. Are you aware that the government subsidizes electricity connection?

A=Yes [ ] B=No [ ] C= Don't know [ ]…….

27. In your view, which form should the subsidy take?.....

28. In your view, do you think the law adequately addresses the issue of access to electricity in rural areas? A=Yes [ ] B=No [ ] C= Don't know [ ]…….

29. What are the issues that the law should address?.....

……
…

30. Are you aware of the rural electrification fund?

A=Yes [ ] B=No [ ] C= Don't know [ ]…….

31. If yes, how does the fund help people in rural areas to access electricity?.....……
……

32. Do you think more awareness of this fund and the way it operates would improve access to electricity in rural areas? A=Yes [ ] B=No [ ] C= Don't know [ ]…….

33. Has the creation of Rural Electrification Authority (REA) improved access to electricity?

A=Yes [ ] B=No [ ] C= Don't know [ ]…….

34. In which ways does REA facilitate access to electricity?.....

……

35. Do you consider this adequate? A=Yes [ ] B=No [ ] C= Don't know […

36. What is your level of agreement with the following statement related to electricity access? Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Statement	1	2	3	4	5
REA's policies on change from the use of traditional sources of energy to electricity has affected access to electricity;					
Distance of household from transformer influences access to electricity in rural areas;					
REA's reduced connection cost of electrification influences access to electricity in rural Kenya;					
Ability to pay electricity bill determines access to electricity in rural Kenya;					
Household level of income influences household electric connectivity;					
Household expenditure influences decisions to connect to grid electricity;					
Reliability of power supply influences household decision on the source of power;					
Decision to connect to grid electricity is informed by electric appliances (such as radio, TV, phones etc);					
Access to electricity by other community members influenced your household's decision to connect to grid electricity;					

37. To what extent do you agree with the following statement related to Regulatory and institutional reforms in the Kenya's electricity sub-sector? Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

a) Regulatory Reforms

Statement	1	2	3	4	5
Regulatory framework affects ERC's performance positively					
Separation of roles (production, policy formulation, regulation, distribution) has improved the performance of ERC.					
Resource allocation to ERC affects its regulatory performance.					
Resource utilization by ERC affects its regulatory performance.					
Regulatory knowledge by regulated utilities has improved access to electricity in the rural areas;					
ERC consults stakeholders in determining tariff rates.					

38. How has been the performance of ERC about the listed indicators? Kindly use the scale of 1-5, where 1-Poor, 2 Fair, 3-Good, 4-Very Good, 5-Excellent.

Indicator	1	2	3	4	5
Energy pricing;					
Provision of subsidies;					
Review of EIA reports;					
Licensing process;					
Complaints handling;					
Drafting of regulations;					
Energy planning.					

39. Do you think the performance of ERC has been affected by the changes in the Energy Act (2014)? A=Yes [ ] B=No [ ] C= Don't know [ ]

40. Briefly explain your answer (above)……

b) Legal Reforms

41. To what extent do you agree with the following statement about Regulatory framework challenges to the performance of ERC. Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Statement	**1**	**2**	**3**	**4**	**5**
Energy Act sets out clear mandate of ERC, KPLC, and REA;					
Energy Act gives ERC the required enforcement powers for it to regulate the energy sector;					
Energy Act is well understood by all players in the energy sector;					
Energy Act is acceptable to all the players in the energy sector as the primary regulatory framework;					
Energy Act adequately addresses the issue of electricity access to rural areas;					
Energy Act adequately addresses the issue of stakeholder participation in rural electrification;					
Legal reforms facilitate access to rural electrification;					

c) Tariffs and Subsidies

42. To what extent do you agree with the following statement about tariffs and subsidies. Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Statement	**1**	**2**	**3**	**4**	**5**
You are aware of government policies on taxation, subsidies and tariffs in the electricity sub-sector;					
Tax on consumption of electricity affects rural electrification;					
Subsidies on rural electrification facilitates access to electricity;					

The price of electricity (monthly bills) determines access to electricity;					
Electricity connection charges determines access to grid electricity;					
Charges in price of electricity affects access to rural electrification;					

Part D: Governance and Reforms

43. Does REA involve you in decision making? A=Yes [ ] B=No [ ] C= Don't know [ ]

If yes, how are you involved?.....

44. In case of complaints, where do you report them?

1 .(KPLC) 2. (REA) 3. (ERC) 4. (others)…….(specify)

45. How adequately are your complaints addressed?.....

46. Are REA offices available in your locality (or county)?

A=Yes [ ] B=No [ ] C= Don't know [ ]

47. If yes, how does this availability influence access to electricity in rural areas?.....

48. Are you aware of any accountability mechanisms to ensure efficient operation of REA/ERC?……

49. In your view, are they working?.....

50. What is your level of agreement with the following statement related to governance issues in the Kenya's electricity sub-sector? Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Statement	1	2	3	4	5
Kenya Power (KP), REA, ERC are very effective and efficient in their service delivery;					
KP efficiently provides electricity in rural areas;					
Incidences of power blackout determines access to electricity by rural households in Kenya;					
I like the level of response to power blackout by KPLC.					
There is adequate citizen participation in governance of rural electrification projects to ensure successful completion;					
ERC has minimized incidences of corruption cases in the electricity sub-sector in Kenya;					
Participation of consumer organizations in the energy sector's reforms has had a considerable impact on electricity access in rural Kenya;					
Consumers are well represented in the Kenya's energy sector structure;					
Management wrangles in the electricity sub-sector has affected electricity connectivity in rural Kenya;					
Legal framework provides for participation of civil society groups such as consumer organization in legal reforms within the energy sector in Kenya;					
Decentralization of decision making from the ministry to ERC has improved connectivity to electricity					
The establishment of Energy Regulatory Commission (an independent commission) has improved access to electricity in rural areas					
There is a framework for consumer interest representation such as redressal mechanisms and a platform for effective consumer participation in regulatory reform process;					
The presence of consumer interest representation in ERC has lead to increased electricity demand in rural areas;					

Part E: Political Factor

51. Do you think politics influences to electricity in your area?

A=Yes [ ] B=No [ ] C= Don't know [ ]

52. In what ways does politics influence access to electricity in your locality?.....

……

53. Should politics influence access to electricity in Kenya?

A=Yes [ ] B=No [ ] C= Don't know [ ]

54. If yes, explain……

55. Are rural electrification projects interfered with by the local politicians?

A. Yes [ ] B. No [ ]

56. Kindly explain your answer above (if Yes) ……

57. What role did your Member of National Assembly/Senator/Member of county Assemble/local leaders play in electrification?.....

Part F: Cooperative Model and Access to Electricity in Rural Kenya

58. Among the following initiatives to promote rural electrification, which one are you familiar with?

a). Umeme pamoja [ ]
b). Stima loans [ ]
c). All [ ]
d). None [ ]
e). Others (specify) []

59. Have you participated in any of these initiatives? a). Yes [ ] b). No [ ]

60. In which initiative (if Yes)?
a). Umeme pamoja [ ]
b). Stima loans [ ]
c). Revolving fund [ ]
d). None [ ]
e). Others (specify) [ ]

61. How much money did you secure from the scheme ? Kshs……...

62. Was this amount enough to facilitate your access to electricity? A=Yes [ ] B=No [ ] C= Don't know [ ]

63. What alternative method would you suggest (different from the above initiatives)

……

64. Are you connected to grid electricity because of your participation in this programme?

a). Strongly Agree b). Agree c). Neutral d). Disagree e). Strongly Disagree

Part G: Alternative Power Sources

65. A part from electricity, is there any other source of energy you use in your household?

A=Yes [ ] B=No [ ] C= Don't know [ ]

66. If yes, what alternative power sources do you use among the following? (*Tick what applies*)

	Kerosene	0=No 1=Yes
	Pressurized lamp	0=No 1=Yes
	Candles	0=No 1=Yes
	Torch	0=No 1=Yes
	Fire wood	0=No 1=Yes
	Solar lumps	0=No 1=Yes
	Others	0=No 1=Yes If 1, specify……..

67. Do you think availability alternative power sources influences access to electricity?

A. Yes [ ] B. No [ ]

68. If yes, in which way (s).....

69. To what extent do you think alternative power sources influence access to electricity in the rural areas?

A. Very Low extent [ ]

B. To lower extension [ ]

C. To moderate extent [ ]

D. To greater extent [ ]

E. To very greater extent [ ]

70. What is your level of agreement with the following statement related to alternative power sources? Kindly use the scale of 1-5, where 1-strongly disagree (SD), 2 disagree (D), 3-neutral (N), 4-agree, (A) 5-strongly agree (SA).

Statement	1	2	3	4	5
The alternative sources of energy available in this community are cheaper than the cost of connecting to the national grid;					
The alternative sources of energy are more reliable than electric energy;					
The type of power source you use depends on your level of income;					
You prefer alternative sources of energy to electricity;					

Thanks for your invaluable information

Appendix II: Interview Guide for REREC and KPLC

1. Your position at REREC, KPLC……
2. For how long have you been working in this position?
3. What are your roles/duties?
4. Could you kindly outline the number of households that have been connected in this area?
5. In your view, in which way (s) does socioeconomic factors affect electricity access in rural areas?
6. How do households in this area know about electricity connection procedures?
7. How do households finance electricity connections?
8. Are households aware of the various innovations financing electricity access?
9. Can you comment on the demand for electricity by households in this area since the establishment of rural electrification? Has it increased of gone down and why?
10. Do you receive adequate funding to carry out rural electrification programmes?
11. What are your sources of funding?
12. Do you think the government is doing enough to facilitate access to electricity in rural areas?
13. Do you think that availability of alternative energy sources such as solar energy affects the demand of electricity?
14. What is your view regarding Kenya's electricity tariff structure and access to electricity in rural Kenya? (*prop for explanation*).
15. How are taxes affecting electricity access in rural areas?
16. How has subsidies affected access to electricity in rural Kenya?
17. What are regulatory reforms in the sector that have occurred in the electricity sub-sector?
18. How has these regulatory reforms influenced access to electricity in Kenya?
19. In what way do consumers participate in decision making of KPLC/REA?
20. Is there legal framework that provides for participation of civil society groups such as consumer organization in legal reforms within the energy sector in Kenya?
21. What role do these civil society groups play (if any)?

22. There are cooperative schemes such Umeme Pamoja, revolving fund and Stima loan. Are households aware of these?
23. To what extent do they participate in these schemes?
24. Is there any new scheme for financing household access to electricity?
25. Which agencies (both government, NGOs, and private) do you collaborate with in discharging your mandate? What is the level of your cooperation?
26. To what extent do you think rural electrification project has succeeded?
27. What challenges does the institution encounter in its quest to electrify rural areas?
28. What policies do you think should be put in place to counter such challenges?
29. What kind of support do you get from local administration? (Village elders, Chiefs, D. O's)
30. Does this organization have enough capacity to carry out its mandate?
31. Has the unbundling of electricity generation from distribution and supply enhanced access to electricity in rural areas;
32. Does politics play any role in your decision making regarding rural electrification, e.g. transformer allocation?
33. What accountability mechanisms are in place to ensure effectiveness in service delivery?
34. Are end of the year financial reports used as accountability tools? (*probe on how well they work*).
35. Do you have any other comment?

Thanks for your invaluable information

Appendix III: Interview Guide for EPRA.

1. Your position at EPRA ……
2. For how long have you been working in position?
3. Could you kindly explain your role in rural electrification programme?
4. Could you kindly comment on EPRA's capacity in the performance of your roles? (*prop on managerial, financial & human resources capacity*)
5. What are policies are in place to promote rural electrification?
6. Could you explain the extent to which these policies are implemented?
7. Do you think REREC and KPLC have sufficient capacity to implement these policies?
8. How does EPRA fund its activities?
9. In your view, are these funding mechanisms adequate for EPRA activities?
10. Do you think that availability of alternative energy sources such as solar energy affects the demand of electric power energy?
11. What are the factors determining electricity tariffs?
12. What is the role of electricity tariffs in rural electrification?
13. What type of subsidies are available for rural households?
14. How has subsidies affected access to electricity in rural Kenya?
15. What are regulatory and legal reforms in the sector?
16. How has these regulatory and legal reforms influenced access to electricity in rural areas?
17. How does EPRA provide for participation of consumer organizations, NGO's in decision making with regard to rural electrification?
18. What role do these civil society groups play in rural electrification?
19. To what extent do you think rural electrification project have succeeded?
20. How does EPRA monitor and evaluate its activities regarding rural electrification?
21. There are cooperative schemes such Umeme pamoja, revolving fund and Stima loan. Are households aware of these?
22. To what extent do they participate in these schemes?
23. Which agencies (both government, NGOs, and private) do you collaborate with in discharging your mandate?

24. What is the level of your cooperation?
25. What challenges does EPRA encounter in its role in rural electrification?
26. What are policies in place to counter such challenges?
27. What do you think needs to change to hasten the pace of rural electrification?
28. What accountability measures are in place to ensure efficient operation of EPRA
29. What new accountability mechanisms do you suggest should be adopted?
30. Are end of the year financial reports used as accountability tools? (*probe on how well they work*)
31. What is the nature of industrial conflicts which occur among electricity service providers?
32. What are the effects of these conflicts on rural electrification?
33. How are these conflicts addressed?
34. Do you have any other comment?

Thanks for your invaluable information

Appendix IV: Interview Guide for CSOS & COS.

1. Your position at CSOs or Cos……
2. Are you aware of rural electrification programme?
3. Are you consulted on policy changes by electricity providers (KPLC, REA) and industry regulator (ERC)?
4. What are policies are in place to promote rural electrification?
5. Could you explain the extent to which these policies are implemented?
6. Do you think REA, ERC and KPLC have sufficient capacity to implement reforms in place to promote rural electrification?
7. What is the effect of availability of alternative energy sources such as solar energy on the demand of electric power energy?
8. Do you think Kenya's electricity tariff structure affects rural electrification? (*prop for explanation*).
9. What are the types of subsidies in the Kenya's rural electrification?
10. How has these subsidies affected access to electricity in rural Kenya?
11. What are regulatory and legal reforms in the sector?
12. How has these regulatory and legal reforms influenced access to electricity in rural areas?
13. Is there legal framework that provides for participation of civil society groups such as consumer organization in legal reforms within the energy sector in Kenya?
14. What roles do these civil society groups play (if any)?
15. There are cooperative schemes such Umeme pamoja, revolving fund and Stima loan. Are households in this county aware of them?
16. To what extent do the households participate in these schemes?
17. Has the participation of households in these schemes affected access to electricity in this county? (*prop for more explanation*).
18. To what extent do you think rural electrification project have succeeded?
19. What challenges do you encounter in providing alternative energy sources/playing your role?
20. What policies do you think should be put in place to counter such challenges?
21. What do you think needs to change to hasten the pace of rural electrification?

Appendix V: NACOSTI Research Permit

THIS IS TO CERTIFY THAT:
MR. MILTON UTWOLO ALWANGA
of JOMO KENYATTA UNIVERSITY OF TECHNOLOGY, 0-505 Nairobi,has been permitted to conduct research in *Kakamega , Nyandarua , Uasin-Gishu Counties*

on the topic: *EFFECT OF REGULATORY REFORMS IN THE ELECTRICITY ENERGY SUBSECTOR ON ACCESS TO ELECTRICITY IN RURAL KENYA.*

for the period ending:
13th March,2020

.....
Applicant's Signature

Permit No : NACOSTI/P/19/33672/28213
Date Of Issue : 14th March,2019
Fee Recieved :Ksh 2000

.....
Director General
National Commission for Science, Technology & Innovation

Appendix VI: Research Authorization-NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471, 2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/33672/28213**

Date: **14th March, 2019**

Milton Utwolo Alwanga
Jomo Kenyatta University of
Agriculture and Technology
P.O. Box 62000-00200
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Effect of regulatory reforms in the electricity energy subsector on access to electricity in rural Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Kakamega, Nyandarua and Uasin Gishu Counties** for the period ending **13th March, 2020.**

You are advised to report to **the County Commissioners and the County Directors of Education, Kakamega, Nyandarua and Uasin Gishu Counties** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kakamega County.

Appendix VII: Research Authorization-County Director of Education Nyandarua

MINISTRY OF EDUCATION
STATE DEPARTMENT OF EDUCATION

Email: cdenyandcounty@yahoo.com
cdenyandcounty@gmail.com
Cellphone: 0718798460
When replying please quote

COUNTY DIRECTOR OF EDUCATION,
NYANDARUA COUNTY,
P.O. BOX 197, -20303
OL-KALOU

REPUBLIC OF KENYA

OUR REF:CDE/NYA/GEN/ 19/VOL 1/ 130 **23rd June, 2019**

Milton Utwolo Alwanga
Jomo Kenyatta University of
Agriculture and Technology
P O Box 62000-00200
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your request to carry out research on ***"Effect of regulatory reforms in the electricity energy subsector on access to electricity in rural Kenya."*** I am pleased to inform you that you are hereby granted permission to carry out your research for the period ending **13th March 2020.**

You are advised to report to the respective Sub-County Directors of Education before commencing on the research project.

We wish you all the best.

COUNTY DIRECTOR OF EDUCATION
NYANDARUA
P. O. Box 197 - 20303,
OL-KALOU

S. N. MAINA
COUNTY DIRECTOR OF EDUCATION
NYANDARUA COUNTY

Copy to: Sub-County Director of Education
KIPIPIRI

Sub-County Director of Education
NYANDARUA WEST

Appendix VIII: Research Authorization-County Director of Education Kakamega

MINISTRY OF EDUCATION
STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

Telephone: 056 – 30411
Fax : 056 – 31307
E-mail : wespropde@yahoo.com
When replying please quote

COUNTY DIRECTOR OF EDUCATION
KAKAMEGA COUNTY
P. O. BOX 137 - 50100
KAKAMEGA

REF: KAK/C/GA/29/17-IV/26

28th June, 2019

Milton Utwolo Alwanga
Jomo Kenyatta University of
Agriculture and Technology
P. O. Box 62000 – 00200
NAIROBI

RE: RESEARCH AUTHORIZATION

The above has been granted permission by National Commission for Science, Technology and Innovation vide their letter Ref: NACOSTI/P/19/33672/28213 dated 14th March, 2019, to carry out research on "**Effects of regulatory reforms in the electricity energy subsector on access to electricity in rural Kenya: Kakamega County, among other Counties in Kenya**", for a period ending **13th March, 2020.**

Please accord him any necessary assistance he may require.

COUNTY DIRECTOR OF EDUCATION
KAKAMEGA COUNTY

DICKSON O. OGONYA
COUNTY DIRECTOR OF EDUCATION
KAKAMEGA COUNTY

CC
Regional Director of Education
WESTERN REGION

Appendix IX: Research Authorization-County Director of Education Uasin Gishu

REPUBLIC OF KENYA

MINISTRY OF EDUCATION

State Department for Early Learning and Basic Education

Mobile : **0721820731**
Email: cdeuasingishucounty@yahoo.com
: cdeuasingishucounty@gmail.com
When replying please quote:

Ref: No. MOEST/UGC/TRN/9/112

Office of The County Director of Education,
Uasin Gishu County,
P.O. Box 9843-30100,
ELDORET.
9TH JULY , 2019

Milton Utwolo Alwanga
Jomo Kenyatta University of Agriculture and Technology
P.O Box 62000-00200
NAIROBI

RE: RESEARCH AUTHORIZATION

This office has received a request from your Institution to authorize you to carry out research on ***"Effect of regulatory reforms in the electricity energy subsector on access to electricity in rural Kenya,"*** Within Uasin Gishu County.

We wish to inform you that the request has been granted until **13th March, 2020.** The authorities concerned are therefore requested to give you maximum support.

We take this opportunity to wish you well during this data collection excercise.

FOR COUNTY DIRECTOR OF EDUCATION
UASIN GISHU COUNTY
P.O. Box 9843, ELDORET
Tel: 0719-127 212/053-2063342

Michael C. Psinen
For: COUNTY DIRECTOR OF EDUCATION
UASIN GISHU.