FACTORS INFLUENCING ADOPTION OF THE ELECTRICITY PREPAYMENT METERING SYSTEM: A CASE OF MAKADARA AND EMBAKASI DIVISIONS, NAIROBI PROVINCE.

BY
SIMIYU VIOLET MUKOSI

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILMENT FOR THE REQUIREMENT OF THE AWARD OF THE DEGREE OF MASTER OF ARTS IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI.

2010

DECLARATION

This project proposal is my original work and has not been submitted for an award or degree in any other University.

Signed ..... Date 15/9/2010

SIMIYU VIOLET MUKOSI

L50/72203/2008

This Research project has been submitted for examination with my approval as the University Supervisor

Signed ..... Date 16/9/2010

DR. CHRISTOPHER GAKUU

LECTURER: DEPARTMENT OF EXTRA MURAL STUDIES

DEDICATION

This proposal is a dedication to my father Frederick Ngachi Simiyu (deceased - 2003) who never hesitated to offer his words of wisdom and good consul. He said "Mum, Education has no limit and it has no end. Whatever you achieve is your success, nobody will ever take that away from you. It is not in vain and it shall never be put to waste – so strive on!" What a motivation what an inspiration! To my dear children Stefany and Concy - I could never have wanted to give you more, than being the best role model a mother could ever be

ACKNOWLEDGMENTS

I wish to express my profound gratitude to all who supported me in this study. Greatly acknowledged is my supervisor Dr Christopher Gakuu; of the University of Nairobi, for the scholarly advice, encouragement and guidance. His being my research methods lecturer, gave me a proper insight hence the road map to research. I also applaud all my course lecturers for preparing me for this work. Their advice and encouragement was immeasurable for it enabled me to forge forward with the determination to succeed.

This research project would not have been possible without the support of Engineer Eluid Limo - Project Engineer Line Construction and Engineer John Wekesa Project Engineer Large Power and Prepayment: both of KPLC. Their knowledge on the subject matter enhanced my insight on the study and this greatly inspired me.

I am forever indebted to my beloved mother – Concepta Naliaka Simiyu, who believes in me and has always encouraged me to pursue further studies. Her inspiration, prayers and good counsel, propel me forward. It is a constant reminder that I can make it. My heartfelt gratitude and indebtness goes to my brother Njalale for the financial support whenever I reached out: My sister-in-law Tabitha and Sella, for the emotional, spiritual and moral support - it was immeasurable. My sincere thanks to Margaret Kimani - she is a friend indeed. The support given to me by each one was continuous and this was very encouraging, may God immensely bless you all.

ABSTRACT

KPLC implemented a prepayment system in Nairobi (currently on pilot) which was to be rolled-out countrywide if successful. Prepayment refers to the payment of services to the utility or service providers before those services are actually rendered. In this case being pre-paid electricity. The 'technology' helps customers manage their power budgets, avoid disconnection for non-payment of bills meaning no more disconnections and reconnection fees required and no more waiting for reconnection after payment. This technology also enables customers avoid queuing to pay their bills over the counter. No more bills or erroneous reading and with the convenience of purchase and the instantaneous supply on loading of credit – thanks to a 24hr and widely distributed vending system made possible, where credit tokens can be sold by third party vendors or through GSM technology like M-Pesa, customers monitor and control electricity usage. Similar electricity prepayment models have been cited in several countries in Africa and in the West, which have applied the technology and adopted it. Countries like South Africa, India, China, in some US states and in the UK. The purpose of this study was to investigate the factors influencing the adoption of the electricity prepayment metering system amongst the residents of Makadara and Embakasi divisions of Nairobi province. The objectives and research questions of this study were to establish how and to what extent the following factors influenced the adoption of the new electricity prepayment metering system: Access to information or lack of it, the level of education, economic status, the benefits of the prepayment metering system and the income levels. Using the Descriptive Survey design, the researcher attempted to correlate these factors and establish how they influenced the consumer's adoptability of the new technology. The aim was also to gauge the success of the prepayment project based on the number of residents in the pilot phase who had adopted this system. Data was collected using questionnaires with open-ended and close-ended questions and interviews. The study revealed that a good percentage of Nairobi's residents would prefer the electricity prepayment metering system as opposed to postpaid. However since the population countrywide is not yet exhausted, with extensive marketing from the power utility - to create awareness and disseminate information, more customers are likely to be brought on board.

TABLE OF CONTENTS

CHAPTER FOUR: DATA PRESENTATION, ANALYSES AND INTERPRETATION

CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSION, RECOMMENDATIONS AND CONCLUSION

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

ATM	Automated Teller Machines
CELCA	Co-operative Electrica Limitada de Carmen de Areco
CDU	Credit Dispensing Unit
CIU	Customer Interface Unit
CVS	Common Vending System
DERC	Delhi State Regulator
ED	Electricity Dispenser
EDI	Electronic Data Interchange
ENG	Engineer (Refers to one's title)
ERB	Electricity Regulatory Board
GOK	Government of Kenya
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
HPSEWB	Himachal Pradesh State Electricity Board
IEC	International Electro-technical Committee
IS	Information Systems
IT	Information Technology
LAN	Local Area Network
KPLC	Kenya Power and Lighting Company
MCU	Meter Control Unit
MDGs	Millennium Development Goals
M-PESA	Brand name for money transfer for Safaricom
NDPL	New Delhi Power Ltd
SABS	South African Bureau of Standards
SMS	System Master Station
STS	Standard Transfer System
TAM	Technology Acceptance Model Theory
UK	United Kingdom
USA	United States of America
WAN	Wide Area Network
WBSEDCL	West Bengal State Electricity Distribution Company Ltd
ZAP	Brand name for money transfer for Zain

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The idea of prepayment metering system was conceived by KPLC in the year 2004. The management adopted it as a strategic vehicle that could be used in managing some of the challenges facing the organization. This strategic business concept was in turn sold to the Board of Directors and it received their consideration and approval on 28th April 2005.

Following the Boards approval, the general planning of the project started in earnest. This involved getting the necessary regulatory approvals from the Electricity Regulatory Board (ERB). This was achieved on 5th October 2005 and the approvals from the government of Kenya (GOK) - Ministry of Energy on 13th October 2005.

Report on the review of prepayment pilot project: Eng Rosemary Gitonga 15/02/2010. A budget of Kshs 318,230,000.00 for 25,000 meters along with management systems and other accessories was approved in respect of 2008/2009 budget for the pilot project. With the aforementioned, the first electricity prepayment meter was installed on 29th April, 2009

1.1.1 Prepayment system

Prepayment refers to the payment of services to the utility or service providers before those services are actually rendered. In this case credit is purchased beforehand and must be replenished before its expiry to avoid automatic discontinuation of services offered by the provider.

1.1.2 Need for Prepayment

In its endeavor to delight its customers, KPLC had proactively been researching for a technology that would not only leverage it as a viable utility but also bench mark it with the best performing utilities in the developing world. The following were the corporate objectives that drove the company to prepaid system: To overcome commercial cycle challenges, loss Reduction, decongestion of KPLC Banking halls, improvement on Customer Service and demand side management.

1.1.3 The Kenya Power & Lighting Company Limited:

KPLC is the only utility that engages in the transmission, distribution, and retail of electricity throughout Kenya. It buys electricity, generated from hydro-power, gas/diesel, geothermal (steam), and wind sources, in bulk from various independent power producers and distributes to approximately 600,000 customers. The company has a network of transmission and distribution lines that stretch for approximately 23,000 kilometers. The Kenya Power & Lighting Company is based in Nairobi, Kenya http://www.kplc.co.ke/

The company said the electricity prepayment model had been applied both in Africa and in the West. A number of African countries had adopted the technology including South Africa, Sudan, Tanzania, Angola, Rwanda, Lesotho, Zambia, Ghana, and Mozambique "Electricity prepayment technology has also been implemented in developed nations like the UK and in some US states. This technology would help customers manage their power budgets, avoid disconnection for non-payment of bills and help them avoid queuing to pay their bills over the counter.

1.2 Statement of the Problem

The bureaucracy consumers go through when seeking reconnection after their power supply is disconnected, was typical of the hustles customers go through with the current post paid metering system. The introduction of the prepaid system was a promising indicator that the long queues at Kenya Power and Lighting Company payment centers could soon be history. Congested banking halls, long queues that are time consuming and all manner of inconveniences are just but a few of the problems associated with reconnection and settling of electricity bills. The question arising was, were the customers willing to adopt the pre-paid electricity metering system? Given the inconveniences/ disadvantages associated with the post-paid metering system and with the rate of diffusion of the new technology, how did this enhance adoptability? This study seeks to establish the factors that influenced the adoption/acceptability of the pre-paid metering system. To-date approximately only 25,000 domestic consumers have been connected to the prepaid metering system Gitonga (2010). This indicates that the majority of the Kenyan electricity consumers are on the postpaid system, therefore they fall victim to the inconveniences associated with the post-paid system as indicated above.

1.3 Purpose of the Study

The intent of the study is to investigate the factors influencing the adoption of the pre-paid electricity meter system in Makadara and Embakasi divisions of Nairobi province. The study aimed at establishing the extent to which each of the following objectives, influenced the level of adoptability: Access to information or lack of it, the level of education, economic status, the benefits of the prepayment metering system and the income levels.

1.4 Research Objectives

The study had five objectives as listed below

1. To establish how access to information or lack of it, influences the consumer's perception on adoption of the electricity prepayment metering system
2. To investigate how the consumer's level of education, influences their adoption of the electricity prepayment metering system.
3. To examine the extent to which the economic status of the consumer influences their adoption of the electricity prepayment metering system.
4. To establish the level at which the awareness of the benefits/advantages of the prepayment metering system influence the consumer's adoption of the electricity prepayment metering system
5. To investigate the extent at which the income levels of the consumer influence their adoption of the electricity prepayment metering system.

1.5 Research Questions

In view of the problem statement, the study aims at addressing the following research questions regarding adoption of the electricity prepayment metering system.

1. How does information or lack of it, influence the readiness of the consumer in adopting the electricity prepayment metering system?
2. How does the level of education of the consumer influence their adoption of the electricity prepayment metering system?
3. How would the economic status of a consumer influence his/her adoption of the electricity prepayment metering system?
4. How do the benefits/advantages of the electricity prepayment metering system influence the consumer's adoption of this system?
5. How do the levels of income of the consumer influence their adoption of the electricity prepayment metering system?

1.6 Significance of the Study

It is hoped that the finds from the study will enlighten the consumer on matters pertaining to the new pre-paid meter paying system. It is also evident from the study that dissemination of information enables the consumer to make informed decisions on prepaid electricity and with intense marketing of the product by the service provider, it facilitates the rate of diffusion and significantly enhances adoptability. Arising from the study, the highlighted benefits/advantages of the technology will not only decongest banking halls but also give the consumer a visual indication of their electricity consumption rate. This allows the consumer manage their own electricity usage, enables them to visually monitor their power consumption rate and avoid disconnection charges for non-payment. The study establishes that the electricity prepayment metering system provides the consumer with a convenient system for purchasing electricity conveniently.

1.7 Assumptions of the Study

1. The estates chosen as a pilot to the project represent Nairobi province as a whole
2. The views expressed by the sample population represents the views of the residents of Nairobi.
3. The results of the findings shall be a true representation of the views of Nairobi's residents on prepaid electricity.

1.8 Limitations of the Study

1.8.1 Factors that presented challenges

The study was limited to Nairobi's pilot estates for pre-paid meters, mainly in Makadara and Embakasi divisions. Being a limited geographical area (compared to the whole population of Nairobi's) the results can only be taken as a general overview of Nairobi residents. Secondly, not all the residents in Nairobi may have been aware of the electricity prepayment metering system prior to installation, their adoption of the technology may have been based on other factors other than those mentioned in the study. Lastly, electricity prepayment being a new technology, the level of ignorance on the subject was high. The researcher had some difficulty in analyzing data collected by questionnaires. Information on this system needed more intense dissemination to create vast awareness.

1.9 Delimitation of the Study

The estates chosen in the pilot project as a sample, were representative of the entire population (in this case being the residents of Nairobi). The generalization can only be limited to Nairobi because the project it is still limited to Nairobi To create awareness and as part of their marketing strategy, s KPLC embarked on educating the customers on what the electricity prepayment concept was all about, on how to purchase credit and where to purchase it (vending stations) How to read their customer interface unit (CIU) and meters, so that they may know when they need to re purchase their credit, How to update credit on their CIU and meter, on how to know how much credit they have available at any given time and how to take care of their CIU and meter And on who to contact if they experienced problems with the CIU and meters (Helplines and call center complaints handling) can now be reached on the following direct landline, 020 – 3201000, and mobile numbers 0711 031000 and 0732 111000. The call center also served as a feedback link between KPLC and the consumer. This enabled the service provider to address other factors that could be inhibiting the level of adoptability and to address the customer's complaints. The consumer was also sprovided with a user- guide/ manual to enhance their knowledge on prepayment. The researcher used personal interviews to triangulate data collected from the questionnaires. Dissemination of information was intensified through the media (TV and Newspapers) to inform and educate consumers. Learning being a continuous process, with time people became aware of innovations thus more receptive to change

1.10 Definition of Significant Terms

1.10.1 Adoption

It is a term used to refer to an act of acceptability to change, be it in the form of new technology, system or way of life

Adoption is similar to diffusion except that it deals with the psychological processes an individual goes through, rather than an aggregate market process. In economics it is more often named "technological change". **Diffusion** is the process by which a new idea or new product is accepted by the market. The **rate of diffusion** is the speed at which the new idea spreads from one consumer to the next.

1.10.2 Consumer/Customer

All users of electricity for Domestic use – Domestic Consumer:

Domestic use includes, lighting, heating/boiling of water for bathing for instance and cooking.

1.10.3 Pre-paid meter (prepayment system)

Refers to consumers who first have the pre-paid meter gadget installed in their premises or house. It also refers to those consumers who purchase units in the form of kilowatts, in advance and load into the pre-paid meter for domestic use. Consumers who enjoy the luxury of controlling their monthly electricity consumption.

1.10.4 Post-paid meter (paying system)

Refers to consumers who mainly would be classified in the category of Industrial consumers Industrial use includes welding, manufacturing of various goods by mechanical or engineering works, heating/ boiling for heavy duty purposes for instance processing of foodstuff. It also refers to the majority of domestic consumers who have not yet been connected to the pre paid meter system. Given that the project is still in its initial stage, the set target of connecting 250,000 consumers to the pre-paid system by December 2010, is still in progress.

1.10.5 Technology

It is a process by which human beings modify nature to meet their needs and wants. Technology is often thought in terms of artifacts like software or an irrigation system but it is more than these tangible products. It includes the entire infrastructure of design, manufacture, operation, modifications, and repairs of the technological artifacts. The knowledge, engineering, technical skills all implored in the development of the artifact are all essential and very crucial. In this case, for instance Actaris Measurements & Systems from South Africa, is a global prepayment technology provider. The technology and the Customer Interface Unit are advanced by Actaris this is the system that KPLC acquired to further advance this technology

1.10.6 Token

This is credit for reloading, basically referred to as "Umeme time"

1.10.7 Pilot Project

These are the initial targeted estates for installation of prepaid electricity meters. They were twenty (20) in number, all located in Nairobi and with a targeted population of 25,000 residents. The Sh388 million pilot project's target was to switch 25,000 customers from the postpaid to the prepaid system by end of February 2010. The project launched in April 2009,had installed 15 317 meters in a number of city estates by December 22nd 2009.The estates included Goldengate – South B, Plainsview, River Bank, Villa Franca, Imara Daima, and Nyayo Embakasi.

1.11 Summary

This chapter dealt with the introduction to the study. The main objective was to highlight the factors that would influence the adoption of the new pre-paid meter paying system. This study is justifiable because once the consumer adopts the pre-paid meter paying system, it will not only decongest banking halls but will allow customers to have a visual indication of their electricity consumption rate, and will also allow them to manage their own electricity usage. It shall enable the customers to visually monitor their power consumption rate and avoid disconnection charges for non-payment, as well as provide a convenient system for them to purchase electricity conveniently.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provided ideas that informed the study. The theoretical basis of the study and the major variables that influenced the adoption of new technology or innovations were considered. The researcher attempted to propose the adoption of pre-paid electricity as opposed to post-paid, based on models and concepts from past research on diffusion on innovations of new technology. The substantial level of investigative activity to date into information systems and technology acceptance and diffusion witnessed the use of a wide range of exploratory techniques examining different systems and technologies in countless different contexts. The aim of this chapter was to provide a comprehensive and systematic review of the literature pertaining to such adoption and diffusion issues in order to ascertain the current "state of play" of the field along a number of dimensions. Information on a series of variables was extracted after conducting a review on articles on Innovation adoption, acceptance and diffusion, published in various reviewed journals especially on detailed review of Rogers' diffusion of innovations theory.

2.2 History of Prepayment Metering System

Prepaid electricity metering systems are being used in more than 40 countries worldwide and more countries are seriously considering its implementation with many trials underway.

2.2.1 Global Review

In the UK, the system has been in use for well over 70 years with about 6 million meters installed out of a total of 45 million electricity and gas meters. Further, mechanical prepayment meters used to be common in rented accommodation. Disadvantages of these included the need for regular visits to remove cash, and risk of theft of the cash in the meter. Modern solid-state electricity meters, in conjunction with smart cards, have removed these disadvantages. The prepayment type of meters were commonly used for customers considered to be a poor credit risk. Payments were usually cushioned using a system known as PayPoint network, where rechargeable tokens (Quantum cards for natural gas, or plastic "keys" for electricity) could be loaded with whatever money the customer had available. Later smartcards were then

introduced as much reliable tokens that allowed two way data exchange between meter and the utility.

In the United States there are approximately 3,000 electricity utilities and prepayment electricity services have been offered in recent years by a small number of municipal and co-operative utilities. Only a few thousand customers had been served by prepaid metering in the US but the method was popular with those customers, who liked paying for power when it suited them, as opposed to when the bill come. They were also able to see the amount of power they were using, and adjusted their habits to save when necessary. One of the major obstacles to prepaid service in the US was the cost of the customer-site equipment. The installed cost of the meter plus customer display cost more than 20 times the cost of a conventional watt-hour meter! However, economic analyses showed that utilities were able to serve some customers with prepaid service at considerable savings compared to conventional, postpaid service. Notably, prepayment was not for everyone in North America, but for many consumers and suppliers it become a preferred way of doing business. www.absenergyresearch.com

In 1993, Cashpower Sudamericana, Landis & Gyr's distributor in Argentina, began marketing the Cashpower prepayment system at a time when some 87% of the population in Argentina had access to electricity. During the previous year, Cashpower Sudamericana had embarked upon an intensive marketing study to evaluate the reaction of users and utilities towards prepayment metering and prepayment systems. Keypad technology was identified as the most suitable. During the period 1992 to 1994, more than 20 co-operatives in Argentina adopted the Cashpower system, replacing conventional meters with prepayment meters. Towards the end of 1994, cooperatives not previously using prepayment technology began implementing it but opted for a cheaper prepayment system in the form of magnetic card meters. This proved to be a costly mistake. Today, in Argentina, there are approximately 150 co-operatives that have implemented prepayment systems using keypad technology, while only three or four are still using the magnetic card concept; and these few are in the process of changing over. The implementation of prepayment metering by CELCA (Co-operative Electrica Limitada de Carmen de Areco) provided an interesting example of how prepayment electricity supply technology was initiated in Argentina. CELCA had over 5,000 users in the city of Carmen de Areco, 140km west of Buenos Aires City. The co-operative was characteristic of the private distribution companies that had actively initiated a prepayment strategy. In May 1996, the co-operative implemented a prepayment system in the province of Buenos Aires. The main reason

for installing prepayment electricity meters was to find a solution for the very high rate of overdue invoices. Delayed payment or non-payment of these invoices averaged nearly 26% of CELCA's total monthly turnover at the time. From the outset, consumer response was highly positive, and surprisingly, even chronic late payers adapted well to the new system and became excellent customers of the co-operative

In the Indian Power Sector, Prepayment Metering is slowly and gradually gaining a foothold. Various utilities in India had embarked upon this journey with approval from the Regulatory bodies. New Delhi Power Ltd (NDPL), West Bengal State Electricity Distribution Co. Ltd (WBSEDCL), Himachal Pradesh State Electricity Board (HPSEB), had all joined the prepayment bandwagon. NDPL was the first private utility to introduce the system for domestic consumers whereas WBSEDCL was the first State Electricity Board to have gone for prepayment. At present many other utilities like HPSEB and Assam Distribution Company, are using the prepayment metering system. So far the experiences from the trials have been fairly successful. They have brought to the fore minor problems of moving from a conventional postpaid system to a prepayment system and few major ones such as tariff rationalization. Realizing the benefits of prepayment system, the Delhi State Government made it mandatory for all its offices in the year 2007. As per the order of Delhi State Government all Government Consumers under Delhi State Government with Single or Three Phase connections and a maximum load up to 45 kW were to be shifted from post-paid meters to advanced keypad based pre paid meters. The Delhi State Regulator (DERC) also came forward in support of prepaid meters and announced a 2% rebate on the tariff for pre-paid consumers.

In China, Shanghai Electric Meter Works (Shanghai Metering Works) was set up in January 1951. The largest scale enterprise, had been growing steadily and at present, Shaghai Metering which consists of over 15 wholly owned and holding manufacturers is one of the largest manufacturers of metering instruments in China. It passed the ISO9001 attestation in 1997 and other international technical certificates. Amongst its main products are such as prepayment metering systems. The products are exported to Europe, United States, Latin America and ASIA by its reliable quality and reasonable prices. It is in great demand in many countries and areas and gets favorable comments of the users.

2.3.2 Regional Perspective

The prepaid programme in South Africa was started in 1992 and since then they have installed over 4 million prepayment meters. Prior to 1988 Eskom supplied electricity mainly to large customers like mines and municipalities. Although Eskom was at that stage already one of the largest electricity generators in the world, they only had about 120 000 customers and all of them were on billed accounts. In 1988 Eskom developed the "Electricity for All" concept intended to supply electricity directly to the large masses of domestic customers that did not have access to electricity at that stage. Some of the problems to overcome included the following:

1. Many customers had to be supported by the smallest number of Eskom personnel. The system therefore had to operate with a low level of management and maintenance. The standard billed system simply required too much day-to day management to process accounts and to maintain connections and disconnections.
2. Many of the areas where potential customers resided had almost no infrastructure. There were no fixed addresses for customers, they did not have permanent jobs or bank accounts and there were no postal services in those areas. All these were requirements for a billed system to operate effectively.
3. Many customers were illiterate and did not understand (or have the budget) to pay for fixed charges or bills that arrived only after the electricity had been consumed

To address these and other problems, Eskom started the development of the basic prepayment system that is currently still in use. This system consisted of:

1. Prepayments meters (also called Electricity Dispensers or EDs)
2. Vending Machines where the customer can purchase electricity credit (known as Credit Dispensing Units or CDUs)
3. Data Concentrators that managed the CDUs and collected the transaction data from the CDUs (Also called System Master Stations or SMSs).

The South African Bureau of Standards produced the first national prepayment meter specification, SABS specification in 1990 with input from the NRS009 specification and it soon replaced the old NRS specification completely. The total contract was steadily increased to a total of 200 000 meters for 1993 and 300 000 per year from 1994 until the year 2000.

During 1993 Eskom also identified the need to standardize the vending systems to be able to sell electricity from one system to meters from various manufacturers. Eskom embarked on a program to standardize the EDs and the vending process and issued an enquiry for a vending system based on a draft specification and for EDs to accompany it. Soon thereafter development was started in conjunction with Conlog to design and build the new Common Vending System (CVS).

To enable the new vending system to transfer credit to all types of meters it was also necessary to develop a standard transfer medium and protocol to the meters. This was also part of the project and thus the "Standard Transfer Specification" STS was born. This Common Vending System and the STS meters form the basis of the prepayment system as it exists today in Eskom.

The Standard Transfer Specification (STS) has become recognized as the only globally accepted open standard for prepayment systems, ensuring inter-operability between system components from different manufacturers of prepayment systems. The application of the technology is licensed through the STS Association, thus ensuring that the appropriate encryption key management practices are applied to protect the security of the prepayment transactions of utilities operating STS systems. It has become established as a de facto worldwide standard for transfer of electricity prepayment tokens since its initial introduction in South Africa in 1993. And subsequently it's publication by the International Electrotechnical Commission as the IEC62055 series of specifications.

The specifications were further improved over the years and are today adopted as the standard by electricity utilities in South Africa. South Africa is now seen as a world leader in prepayment technology and many other countries have adopted their standards as well.

The SANS1524 specification from the SABS was used as a major source during the development of the international IEC specification for payment meters. Further more, the STS standard has since been adopted by the IEC , and the STS Association is currently working on the development of STS2.

2.2.3 Pre paid metering in Kenya

Prepaid metering systems are known to reduce system load due to the enhanced customer consciousness in energy conservation. This formed part of the basis for KPLC's decision to

adopt this technology. Energy systems are the key drivers of economic and social development globally, especially electrical energy. To keep up with the rapidly rising demand for electricity, the Electricity generating companies worldwide planned on tripling their generating capacities by 2015-2020. Most of the new plants built would burn fossil oil. This trend led to greatly increased emissions of carbon dioxide and other greenhouse gases which became a global concern due to climate change. Therefore, measures that would increase the efficient use of energy were imperative especially in developing countries which do not readily attract investors in energy generation due to perceived political risks. Hence, utilities in these countries had to embrace Demand Side Management initiatives, which KPLC did.

Findings suggest that the positivist paradigm, empirical and quantitative research, the survey method and Technology Acceptance Model - TAM theory - have been utilized predominantly when investigating the topics of adoption and diffusion of technology or to study an assortment of adoption and diffusion related issues. Recently, Information Systems - IS researchers begun stretching their reach beyond the commonly addressed organization and user perspectives. For example, studies related specifically to the adoption of technology within the household context began to emerge (Dwivedi et al. 2006; Venkatesh and Brown, 2001, 2003; 2005) adding yet further variability to the body of existing research in terms of contexts and units of analysis.

2.3 Technology-related studies based on Rogers' Theory

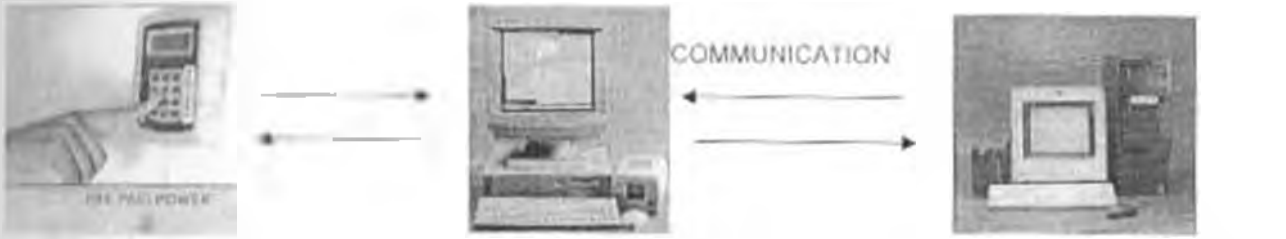
Rogers (1983) proposes innovation diffusion theory to explain how innovation spreads. Innovation diffusion is defined as the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1983). Swanson (1994) also defines innovation from the perspective of an information system as "innovation in the application of digital and communications technologies" (p. 1072). Premkumar et al. (1994) study the implementation of electronic data interchanges (EDI) with Innovation diffusion theory.

The fast revolution of wireless technology brought advent for everything prepaid, from cell-phone loads to every device or transaction that can be digitalized or electronically manufactured. The discovery of wireless communication of cellular phones today has always been a great reward in this century for the ingenuity of human's continuous exploration for

easy living. The cellular phones and telecommunication and network providers offer us faster and efficient ways to save our time and human energy in dealing with our monthly routine such as bank-to-bank payments for electric bill, water bill, cash deposit, etc., and amazingly, everything has been done through text messaging alone.

The understanding of the new system (Prepaid electricity metering system) which is modeled along the mobile phone scratch card system, where one pays for airtime upfront is critical in the successful implementation of the project. The technology enabled customers to purchase power units dubbed 'Umeme Time' to load in the same way they do for mobile phone airtime. In addition, 'Umeme time' would be available conveniently from vending units in all estates and shopping centres" thus ending the bureaucracy consumers go through when seeking reconnection after their power supply is disconnected. The results of the research will therefore give an indication to the success factor of adoption of the new pre-paid meter.

How the Prepayment system works



prepayment meter at customer's home

vending station at utility's office or appointed agent

system master station (sms) in stima plaza data centre

Figure 1. The Prepayment system

The system is simple but extremely effective. Prepayment Meters are installed in customers' premises but before electricity can be consumed a credit token must be entered into the meter. The token is purchased at a conveniently located Vending Station. The token is inserted into the meter where it is decrypted and added to the meter credit register. Should the credit expire the meter automatically disconnects the load and only reconnects when more credit is added. The tokens that are dispensed by the vending stations are derived online from a centrally located Master Station (Eclipse Server), providing the utility full management and control of its sales and service history. The communication between the master station and the vending stations is online and may be in the form of LAN/WAN, leased lines, GSM or GPRS.

Requirements for Din Mounted Split Metering

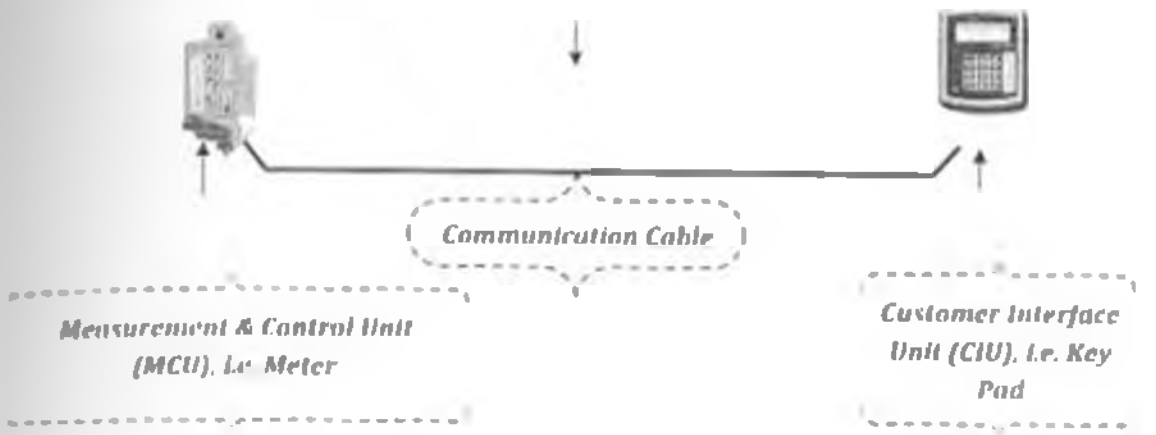


Figure 2. Din Mounted Split Metering

The prepaid technology has contributed to many households cutting their budget in electric energy consumption, and this technology secures irresponsible tenants for commercial and leasing establishments from escaping from their own power supply.

2.3.1 Standard Transfer System (STS)

Standard Transfer System (STS), which is an open standard, was developed to ensure that meters from different manufactures could work together. Initially all prepayment systems used proprietary methods to encode and transfer credit from the vending points to the meters. This meant different systems and meters from different manufacturers could not communicate, thereby making a utility to be tied to one supplier. Any utility using an STS vending system could purchase STS meters from any supplier. The STS specification has now been published by the IEC' as a Publicly Available Specification — **IEC62055-41.** Currently **STS** is only specified for Keypad systems.

2.3.2 Selection of Electricity Prepayment Technology for KPLC

During the research for technology a comparison was made between the two prepayment systems that were identified by the research team. (STS) Keypad Prepayment System was identified as the most suitable technology for KPLC as it best addressed it's objectives, such as being cost effective, the decongestion of the banking halls and enhancement of ease of

payment bit due to its versatile feature of having various vending channels. These are vide SMS (mobile phone), POS (Credit Debit Card), Internet, Vouchers (scratch cards), third parties (retail chains, banks, ATMs) amongst others.

The Split Meter type was identified as the one to be adopted since it is good in loss reduction due to its good anti tamper features. The metering of households and company's electric consumption has been patterned to the ballooning figures in communication via open atmosphere. The combination of electric and electronic features of prepaid kilowatt-hour meter has been considered one of the breakthroughs in rendering service of electric company. To enhance this the electricity distributor Kenya Power and Lighting Company is set to roll out a Vendor system by end of February 2010.

2.3.3 The Vendor system

The Prepayment Steering Committee approved a hybrid vending structure for KPLC that included the following:

Direct vending channels through KPLC banking halls, Some major dealers with national coverage, Mobile Service Provider products (ZAP & M-Pesa). Deploying of Cell Phone vending for the rural areas and informal settlements, SMS or Scratch Card Vending, Engagement of Regional/Local vendor (e.g. single shop or other outlet) where the situation demands and Engagement of several Super Vendors.

KPLC began with M-Pesa of Safaricom and the search for other prospective service providers such as ZAP of Zain and 3rd Party vendors, are ongoing and it is expected that other players will be incorporated. Currently KPLC is looking for agents to sell scratch cards for its pre-paid metering system in a move that could create thousands of jobs countrywide. The move is also expected to boost the earnings of micro-entrepreneurs, who are already acting as agents of the country's top telecoms operators Safaricom and Zain, which have opened negotiations with KPLC to enable the agents help sell the cards.

There are close to 17,000 agents in the mobile phone money transfer business in the country. KPLC is also planning to recruit its own agents, a move that should open new employment and business opportunities for thousands of Kenyans adding to the more than 100,000 jobs that mobile telephony is estimated to have created in the past eight years. Official data shows that airtime vendors last year earned Sh4.6 billion in commissions a figure that could significantly improve with the sale of electricity scratch cards. "Negotiations with third party vendors such as Safaricom and Zain are ongoing We expect to have them on board before long," said a

progress report on the pre-paid metering system. Under the new payment system, electricity consumers will buy cards before hand to top up their meters before expiry of their credit to avoid automatic disconnection.

The new meters that use smart cards are bought from KPLC and loaded with the amount of credit purchased. The card is then inserted in the new meters, which subtracts the points according to consumption. Just like the prepaid mobile phone system, the prepaid electricity meter will switch off power immediately a consumer has exhausted his credit and on reloading the card automatically reconnect. Currently, consumers can only access the cards from KPLC banking halls and three Uchumi Supermarkets, making that addition of more access points a critical plank in the success of the pre paid metering now that the power firm is planning a massive rollout. The power firm was yet to release details on the amount of commission the agents would earn or the criteria it used to pick the agents since one might be required to deposit some money. It was not clear whether the power firm would follow the model of mobile phone providers where dealers get products – top-up cards and handsets – at a discount and sell them at the fixed retail price, or by purchasing starter packs at the retail price and then receiving a connection commission once an initial top-up is made by a new subscriber. But given that the revenues generated from the pre-paid system run into billions of shillings, the agency deal is expected to generate a high stake battle for the business as investors look for the handsome pay-offs. Business Daily (Nairobi) 8 October 2009, Zeddy Sambu.

Prepaid Electricity metering system also allows KPLC to collect money for its services upfront, hence improving revenues which presumably translates to providence of better services to its customers. KPLC will benefit by decongesting its banking halls, collecting its revenue upfront as well as reducing its operational costs of disconnection, reconnection and meter reading – hopefully for the customer this will translate onto better services aimed at customer satisfaction

2.4 Innovation Diffusion Theory

The process of adopting new innovations has been studied for over 30 years, and one of the most popular adoption models is described by Rogers in his book, Diffusion of Innovations (Sherry & Gibson, 2002). Much research from a broad variety of disciplines has used the model as a framework. Dooley (1999) and Stuart (2000) mentioned several of these disciplines as political science, public health, communications, history, economics, technology, and

education, and defined Rogers' theory as a widely used theoretical framework in the area of technology diffusion and adoption.

Rogers' diffusion of innovations theory is the most appropriate for investigating the adoption of technology in higher education and educational environments (Medlin, 2001; Parisot, 1995). In fact, much diffusion research involves technological innovations so Rogers (2003) usually used the word "technology" and "innovation" as synonyms. For Rogers, "a technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (p. 13)

It is composed of two parts: Hardware and Software

Hardware is "the tool that embodies the technology in the form of a material or physical object," software is "the information base for the tool" (Rogers, 2003, p. 259). Since software (as a technological innovation) has a low level of observability, its rate of adoption is quite slow. In this study the hardware is the pre paid meter component and the software is the 'token' purchased from the power utility KPLC, for purposes of re-loading hence ensuring continuous supply of electricity.

For Rogers (2003), adoption is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation" (p. 177). Rogers defines diffusion as "the process in which an innovation is communicated thorough certain channels over time among the members of a social system" (p. 5).
As expressed in this definition, innovation, communication channels, time, and social system are the four key components of the diffusion of innovations.

2.5 Four main Elements in the Diffusion of Innovations

2.5.1 Innovation

Rogers offered the following description of an innovation: "An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12) An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them The newness characteristic of an adoption is more related to the three steps (knowledge, persuasion, and decision) of the innovation-

decision process that will be discussed later. In addition, Rogers claimed there is a lack of diffusion research on technology clusters. For Rogers (2003), "a technology cluster consists of one or more distinguishable elements of technology that are perceived as being closely interrelated" (p. 14).

Uncertainty is an important obstacle to the adoption of innovations. An innovation's consequences may create uncertainty: "Consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation" (Rogers, 2003, p. 436). To reduce the uncertainty of adopting the innovation, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences. Moreover, Rogers claimed that consequences can be classified as desirable versus undesirable (functional or dysfunctional), direct versus indirect (immediate result or result of the immediate result), and anticipated versus unanticipated (recognized and intended or not).

2.5.2 Communication Channels

Second element of the diffusion of innovations process is communication channels. For Rogers (2003), communication is "a process in which participants create and share information with one another in order to reach a mutual understanding" (p. 5). This communication occurs through channels between sources. Rogers states that "a source is an individual or an institution that originates a message. A channel is the means by which a message gets from the source to the receiver" (p. 204).

Rogers also states that diffusion is a specific kind of communication and includes these communication elements: Innovation, two individuals or other units of adoption, and a communication channel - Mass media and interpersonal communication are two communication channels. While mass media channels include a mass medium such as TV, radio, or newspaper, interpersonal channels consist of a two-way communication between two or more individuals.

On the other hand, "diffusion is a very social process that involves interpersonal communication relationships" (Rogers, 2003, p. 19). Thus, interpersonal channels are more powerful to create or change strong attitudes held by an individual. In interpersonal channels, the communication may have a characteristic of homophily, that is, "the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs, education, socioeconomic status, and the like," but the diffusion of innovations requires at least some degree of heterophily, which is "the degree to which two or more individuals who interact are

different in certain attributes." In fact, "one of the most distinctive problems in the diffusion of innovations is that the participants are usually quite heterophilous" (Rogers, 2003, p. 19). Communication channels also can be categorized as localite channels and cosmopolite channels that communicate between an individual of the social system and outside sources. While interpersonal channels can be local or cosmopolite, almost all mass media channels are cosmopolite. Because of these communication channels' characteristics, mass media channels and cosmopolite channels are more significant at the knowledge stage and localite channels and interpersonal channels are more important at the persuasion stage of the innovation-decision process (Rogers, 2003).

2.5.3 Time

According to Rogers (2003), the time aspect is ignored in most behavioral research. He argues that including the time dimension in diffusion research illustrates one of its strengths. The innovation-diffusion process, adopter categorization, and rate of adoptions all include a time dimension. These aspects of Rogers'

2.5.4 Social System

The social system is the last element in the diffusion process. Rogers (2003) defined the social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (p. 23). Since diffusion of innovations takes place in the social system, it is influenced by the social structure of the social system. For Rogers (2003), structure is "the patterned arrangements of the units in a system" (p. 24). He further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters.

2.6 The Innovation-Decision Process

Rogers (2003) described the innovation decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (p. 172). For Rogers (2003), the innovation decision process involves five steps. (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. These stages typically follow each other in a time-ordered manner.

The "Knowing" Stage

The innovation-decision process starts with the knowledge stage.
In this step, an individual learns about the existence of innovation and seeks information about the innovation. "What?," "how?" and "why?" are the critical questions in the knowledge phase. During this phase, the individual attempts to determine "what the innovation is and how and why it works" (Rogers, 2003, p. 21). According to Rogers, the questions form three ways of knowing, awareness, how-to-know and principles.

2.6.1 Awareness

Awareness-knowledge represents the knowledge of the innovation's existence.
This type of knowledge can motivate the individual to learn more about the innovation and, eventually, to adopt it. It may also encourage an individual to learn about other two types of knowledge

2.6.2 How-to- know

The other type of knowledge, how-to knowledge, contains information about how to use an innovation correctly. As Wetzel (1993) stated, even the faculty who have technical backgrounds may not use technology in teaching, if they do not have knowledge of how to use it correctly. Thus, technology is not used at an expected level, since they need help in how to use the technology effectively in teaching (Spotts, 1999). Rogers saw this knowledge as an essential variable in the innovation-decision process. To increase the adoption chance of an innovation, an individual should have a sufficient level of how-to-knowledge prior to the trial of this innovation. Thus, this knowledge becomes more critical for relatively complex innovations.

2.6.3 Principles-knowledge

The last knowledge type is principles-knowledge. This knowledge includes the functioning principles describing how and why an innovation works. An innovation can be adopted without this knowledge, but the misuse of the innovation may cause its discontinuance. For Sprague et al. (1999), the biggest barrier to faculty use of technology in teaching was that faculty lack a vision of why or how to integrate technology in the classroom. To create new knowledge, technology education and practice should provide not only a how-to experience but also a know-why experience (Seemann, 2003). In fact, an individual may have all the

knowledge, but this does not mean that the individual will adopt the innovation because the individual's attitudes also shape the adoption or rejection of the innovation.

2.6.4 The Persuasion Stage

The persuasion step occurs when the individual has a negative or positive attitude toward the innovation, but "the formation of a favorable or unfavorable attitude toward an innovation does not always lead directly or indirectly to an adoption or rejection" (Rogers, 2003, p. 176). The individual shapes his or her attitude after he or she knows about the innovation, so the persuasion stage follows the knowledge stage in the innovation-decision process. Furthermore, Rogers states that while the knowledge stage is more cognitive- (or knowing-) centered, the persuasion stage is more affective- (or feeling-) centered. Thus, the individual is involved more sensitively the innovation at the persuasion stage. The degree of uncertainty about the innovation's functioning and the social reinforcement from others (colleagues, peers, etc.) affect the individual's opinions and beliefs about the innovation. Close peers' subjective evaluations of the innovation that reduce uncertainty about the innovation outcomes are usually more credible to the individual: "While information about a new innovation is usually available from outside experts and scientific evaluations, teachers usually seek it from trusted friends and colleagues whose subjective opinions of a new innovation are most convincing" (Sherry, 1997, p. 70). Individuals continue to search for innovation evaluation information and messages through the decision stage.

2.6.5 The Decision Stage

At the decision stage in the innovation decision process, the individual chooses to adopt or reject the innovation. While adoption refers to "full use of an innovation as the best course of action available," rejection means "not to adopt an innovation" (Rogers, 2003, p. 177). If an innovation has a partial trial basis, it is usually adopted more quickly. Findings of a recent customer satisfaction study shows that many prefer the prepaid system because it gives them the power to control their consumption. Based on this concept, most individuals first want to try the innovation in their own situation and then come to an adoption decision. The vicarious trial can speed up the innovation-decision process. However, rejection is possible in every stage of the innovation-decision process.

Rogers expressed two types of rejection: Active rejection and Passive rejection.

In an active rejection situation,

An individual tries an innovation and thinks about adopting it, but later he or she decides not to adopt it. A discontinuance decision, which is to reject an innovation after adopting it earlier, may be considered as an active type of rejection.

In a passive rejection (or non adoption) position,

The individual does not think about adopting the innovation at all. Rogers stated that these two types of rejection have not been distinguished and studied enough in past diffusion research. In some cases, the order of the knowledge-persuasion-decision stages can be knowledge-decision-persuasion. Especially in collectivistic cultures such as those in Eastern countries, this order takes place and group influence on adoption of an innovation can transform the personal innovation decision into a collective innovation decision (Rogers, 2003). In any case, however, the implementation stage follows the decision stage.

2.6.6 The Implementation Stage

At the implementation stage, An innovation is put into practice. However, an innovation brings the newness in which "some degree of uncertainty is involved in diffusion" (p. 6). Uncertainty about the outcomes of the innovation still can be a problem at this stage. Thus, the implementer may need technical assistance from change agents and others to reduce the degree of uncertainty about the consequences. Moreover, the innovation-decision process will end, since "the innovation loses its distinctive quality as the separate identity of the new idea disappears" (Rogers, 2003, p. 180)

Reinvention usually happens at the implementation stage, so it is an important part of this stage. Reinvention is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers, 2003, p. 180). Also, Rogers (2003) explained the difference between invention and innovation. While "invention is the process by which a new idea is discovered or created," the adoption of an innovation is the process of using an existing idea" (Rogers, 2003, p. 181).

Rogers further discussed that the more reinvention takes place, the more rapidly an innovation is adopted and becomes institutionalized. As innovations, computers are the tools that consist of many possible opportunities and applications, so computer technologies are more open to reinvention.

2.6.7 The Confirmation Stage

The innovation-decision already has been made, but at the confirmation stage the individual looks for support for his or her decision. According to Rogers (2003), this decision can be reversed if the individual is "exposed to conflicting messages about the innovation" (p. 189). However, the individual tends to stay away from these messages and seeks supportive messages that confirm his or her decision. Thus, attitudes become more crucial at the confirmation stage. Depending on the support for adoption of the innovation and the attitude of the individual, later adoption or discontinuance happens during this stage.

Discontinuance may occur during this stage in two ways.

1. First, the individual rejects the innovation to adopt a better innovation replacing it. This type of discontinuance decision is called replacement discontinuance.
2. The other type of discontinuance decision is disenchantment discontinuance. In the latter, the individual rejects the innovation because he or she is not satisfied with its performance. Another reason for this type of discontinuance decision may be that the innovation does not meet the needs of the individual. So, it does not provide a perceived advantage, which is the first attribute of innovations and affects the rate of adoption.

2.7 Attributes of Innovations and rate of Adoption

Rogers (2003) described the innovation-diffusion process as "an uncertainty reduction process" (p. 232), and he proposes attributes of innovations that help to decrease uncertainty about the innovation.

Attributes of innovations includes five characteristics of innovations, relative advantage, compatibility, complexity, trialability, and observability.

Rogers (2003) stated that "individuals' perceptions of these characteristics predict the rate of adoption of innovations" (p. 219). Also, Rogers noted that although there is a lot of diffusion research on the characteristics of the adopter categories, there is a lack of research on the effects of the perceived characteristics of innovations on the rate of adoption.

Rogers (2003) defined the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" (p. 221). For instance, the number of individuals who adopted the innovation for a period of time can be measured as the rate of adoption of the innovation. The perceived attributes of an innovation are significant predictors of the rate of adoption. Rogers reported that 49-87% of the variance in the rate of adoption of innovations is

explained by these five attributes. In addition to these attributes, the innovation-decision type (optional, collective, or authority), communication channels (mass media or interpersonal channels), social system (norms or network interconnectedness), and change agents may increase the predictability of the rate of adoption of innovations. For instance, personal and optional innovations usually are adopted faster than the innovations involving an organizational or collective innovation-decision. However, for Rogers, relative advantage is the strongest predictor of the rate of adoption of an innovation.

2.7.1 Relative Advantage

Rogers (2003) defined relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 229). The cost and social status motivation aspects of innovations are elements of relative advantage. For instance, while innovators, early adopters, and early majority are more status-motivated for adopting innovations, the late majority and laggards perceive status as less significant. Moreover, Rogers categorized innovations into two types: preventive and incremental (non-preventive) innovations. "A preventive innovation is a new idea that an individual adopts now in order to lower the probability of some unwanted future event" (Rogers, 2003, p. 233). Preventive innovations usually have a slow rate of adoption so their relative advantage is highly uncertain. However, incremental innovations provide beneficial outcomes in a short period. When faculty members face the new demands placed on them, they will adopt technology (Casmar, 2001). If teachers see that technology has value in their instruction, then they will use it (Finley, 2003; McKenzie, 2001; Parisot, 1995; Spotts, 1999).

To integrate technology successfully into teacher education courses, teacher education faculty should see the need providing helpful experiences for themselves and their students (Schmidt, 1995).

To increase the rate of adopting innovations and to make relative advantage more effective, direct or indirect financial payment incentives may be used to support the individuals of a social system in adopting an innovation. Incentives are part of support and motivation factors. Another motivation factor in the diffusion process is the compatibility attribute.

2.7.2 Compatibility

In some diffusion research, relative advantage and compatibility were viewed as similar, although they are conceptually different. Rogers (2003) stated that "compatibility is the degree

which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (p. 15). A lack of compatibility in Information Technology II, with individual needs may negatively affect the individual's IT use (McKenzie, 2001; Sherry, 1997).

In her literature review, Hoerup (2001) describes that each innovation influences teachers' opinions, beliefs, values, and views about teaching. If an innovation is compatible with an individual's needs, then uncertainty will decrease and the rate of adoption of the innovation will increase. Thus, even naming the innovation is an important part of compatibility. What the innovation is called should be meaningful to the potential adopter. What the innovation means also should be clear. This is part of the complexity attribute.

2.7.3 Complexity

Rogers (2003) defined complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 15). As Rogers stated, opposite to the other attributes, complexity is negatively correlated with the rate of adoption. Thus, excessive complexity of an innovation is an important obstacle in its adoption.

A technological innovation might confront faculty members with the challenge of changing their teaching methodology to integrate the technological innovation into their instruction (Parisot, 1995), so it might have different levels of complexity. If hardware and software are user-friendly, then they might be adopted successfully for the delivery of course materials (Martin, 2003).

2.7.4 Trialability

According to Rogers (2003), "trialability is the degree to which an innovation may be experimented on a limited basis" (p. 16). Also, trialability is positively correlated with the rate of adoption. The more an innovation is tried, the faster its adoption is. As discussed in the implementation stage of the Innovation-decision process, reinvention may occur during the trial of the innovation. Then, the innovation may be changed or modified by the potential adopter. Increased reinvention may create faster adoption of the innovation. For the adoption of an innovation, another important factor is the vicarious trial, which is especially helpful for later adopters. However, Rogers stated that earlier adopters see the trialability attribute of innovations as more important than later adopters.

2.7.5 Observability

The last characteristic of innovations is observability. Rogers (2003) defined observability as "the degree to which the results of an innovation are visible to others" (p. 16). Role modeling (or peer observation) is the key motivational factor in the adoption and diffusion of technology (Parisot, 1997). Similar to relative advantage, compatibility, and trialability, observability also is positively correlated with the rate of adoption of an innovation.

In summary, Rogers (2003) argued that innovations offering more relative advantage, compatibility, simplicity, trialability, and observability will be adopted faster than other innovations. Rogers does caution, "getting a new idea adopted, even when it has obvious advantages, is difficult" (p. 1), so the availability of all of these variables of innovations speed up the innovation-diffusion process. Research showed that all these factors influenced faculty members' likelihood of adopting a new technology into their teaching (Anderson et al., 1998; Bennett, & Bennett, 2003; Parisot, 1997; Slyke, 1998; Surendra, 2001).

2.8 Adopter Categories

Rogers (2003) defined the adopter categories as "the classifications of members of a social system on the basis of innovativeness" (p. 22). This classification includes innovators, early adopters, early majority, late majority, and laggards. In each adopter category, individuals are similar in terms of their innovativeness: "Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system" (Rogers, 2003, p. 22). Braak (2001) described innovativeness as "a relatively-stable, socially-constructed, innovation-dependent characteristic that indicates an individual's willingness to change his or her familiar practices" (p. 144). For Rogers, innovativeness helped in understanding the desired and main in the innovation-decision process. Thus, he categorizes the adopters based on innovativeness.

Also, Rogers (2003) noted that incomplete adoption and non-adoption do not form this adopter classification. Only adopters of successful innovations generate this curve over time. In this normal distribution, each category is defined using a standardized percentage of respondents. For instance, the area lying under the left side of the curve and two standard deviations below the mean includes innovators who adopt an innovation as the first 2.5% of the individuals in a system

2.8.1 Innovators

For Rogers (2003), innovators were willing to experience new ideas. Thus, they should be prepared to cope with unprofitable and unsuccessful innovations, and a certain level of uncertainty about the innovation. Also, Rogers added that innovators are the gatekeepers bringing the innovation in from outside of the system. They may not be respected by other members of the social system because of their venturesomeness and close relationships outside the social system. Their venturesomeness requires innovators to have complex technical knowledge.

2.8.2 Early Adopters

Compared to innovators, early adopters are more limited with the boundaries of the social system. Rogers (2003) argued that since early adopters are more likely to hold leadership roles in the social system, other members come to them to get advice or information about the innovation. In fact, "leaders play a central role at virtually every stage of the innovation process, from initiation to implementation, particularly in deploying the resources that carry innovation forward" (Light, 1998, p. 19). Thus, as role models, early adopters' attitudes toward innovations are more important. Their subjective evaluations about the innovation reach other members of the social system through the interpersonal networks. Early adopters' leadership in adopting the innovation decreases uncertainty about the innovation in the diffusion process. Finally, "early adopters put their stamp of
approval on a new idea by adopting it" (Rogers, 2003, p. 283).

2.8.3 Early Majority

Rogers (2003) claimed that although the early majority have a good interaction with other members of the social system, they do not have the leadership role that early adopters have. However, their interpersonal networks are still important in the innovation-diffusion process. As Figure 2.2 shows, the early majority adopts the innovation just before the other half of their peers adopts it. As Rogers stated, they are deliberate in adopting an innovation and they are neither the first nor the last to adopt it. Thus, their innovation decision usually takes more time than it takes innovators and early adopters.

2.8.4 Late Majority

Similar to the early majority, the late majority includes one-third of all members of the social system who wait until most of their peers adopt the innovation. Although they are skeptical about the innovation and its outcomes, economic necessity and peer pressure may lead them to the adoption of the innovation. To reduce the uncertainty of the innovation, interpersonal networks of close peers should persuade the late majority to adopt it. Then, "the late majority feel that it is safe to adopt" (Rogers, 2003, p. 284).

2.8.5 Laggards

As Rogers (2003) stated, laggards have the traditional view and they are more skeptical about innovations and change agents than the late majority. As the most localized group of the social system, their interpersonal networks mainly consist of other members of the social system from the same category. Moreover, they do not have a leadership role. Because of the limited resources and the lack of awareness-knowledge of innovations, they first want to make sure that an innovation works before they adopt. Thus, laggards tend to decide after looking at whether the innovation is successfully adopted by other members of the social system in the past. Due to all these characteristics, laggards' innovation-decision period is relatively long.
In addition to these five categories of adopters, Rogers (2003) further described his five categories of adopters in two main groups: earlier adopters and later adopters.

1. Earlier adopters:
   Consist of innovators, early adopters and early majority
2. Later adopters.
   Consist of late majority and laggards

Rogers identifies the differences between these two groups in terms of socioeconomic status, personality variables, and communication behaviors, which usually are positively related to innovativeness. For instance, "the individuals or other units in a system who most need the benefits of a new idea (the less educated, less wealthy, and the like) are generally the last to adopt an innovation" (Rogers, 2003, p. 295). For Rogers, there was no significant difference between the ages of earlier adopters and later adopters, but this categorization and its characteristics are beyond this study.

2.9 Factors that influence Adoption

1. Access to information or lack of it:

This aimed at establishing whether the consumer had any knowledge on the prepayment electricity or not Information creates awareness which enables the consumer to understand the concept of the new technology and make informed decisions on the same.

2 Education Level:

How does the consumer's level of education influence his/her adoption of the electricity prepayment metering system. Education contributes significantly to one's intelligence.

3 Economic status

Depending on a consumer's source of income, this addresses the issue of affordability and household budgeting. Seeks to determine if it is more viable to pay for electricity before consumption or after?

4 Benefits advantages of the prepayment system

Once a consumer is aware of the benefits/advantages of the prepayment system, it contributes to their decision making- to adopt or not to. Hence their being able to make informed decisions.

5. Level of income

The consumer's pay package will determine whether they can adopt the prepayment system or not In Kenya we have different categories of employees, casual or manual laborers, middle level working class and the executives. The level of a consumer's income is critical in decisions concerning financial expenditure

2.10 Prepayment Pilot Project Implementation Strategy

In correlation with Rogers' theories on adoption, KPLC came up with a marketing strategy so as to enhance adoptability. A working committee was constituted, whose primary responsibility was to ensure the total buy-in of the new service, by all parties concerned. The membership was made of Customer relations, marketing and corporate communication. Other responsibilities of the working committee included:

1. building positive relations with pilot target groups so as to enlist their full support for the new product,

2. to establish an efficient feedback and response system so that customer queries and problems are solved within the shortest time,
3. disseminate vital information to target customers on the benefits of this new product,
4. conduct surveys where necessary and to find out where the service needs improvement, or which new services may be required.
5. to keep internal customers posted on this new service and its benefits.
6. get feedback from internal customers and respond to it.
7. develop the brand name for the new product
8. develop advertising as well as door-to-door campaigns and road shows for brand penetration and acceptance of the target group of customers.
9. Develop rapport with all stakeholders, to ensure and enlist their support.
10. Prepare presentations to internal, external customers and other stakeholders, to ensure the product is fully understood and supported by them

The aim was to enhance the general goodwill form all parties concerned, hence guarantee the smooth transition and acceptance of the new service.

The summarized action plan was to select the target customers, select agents and vending points and train the vendors on the system, and how to promote it to users by creating and acceptance of an advertising theme. Using the necessary resources, KPLC would develop the brochures and posters, determine if the test area has any community leaders or committee, visit the group/committee and enlist their support for the project. This exercise would involve some incentive e.g. free t-shirts and caps. KPLC in conjunction with the community leaders/committee was to set up a meeting with the customers, train the installation teams and call center staff to train the customer in the use of the system. It was paramount that for customers to buy this idea, they must feel that they will own it and feel privileged to use it. The messages relayed to them were well thought-out, clear and to the point. While this system brought benefits to both KPLC and it's customers, KPLC was mandated to ensure that the customers saw this system as purely for their benefit, least a situation arose where customers would form irreversible negative opinions about the project.

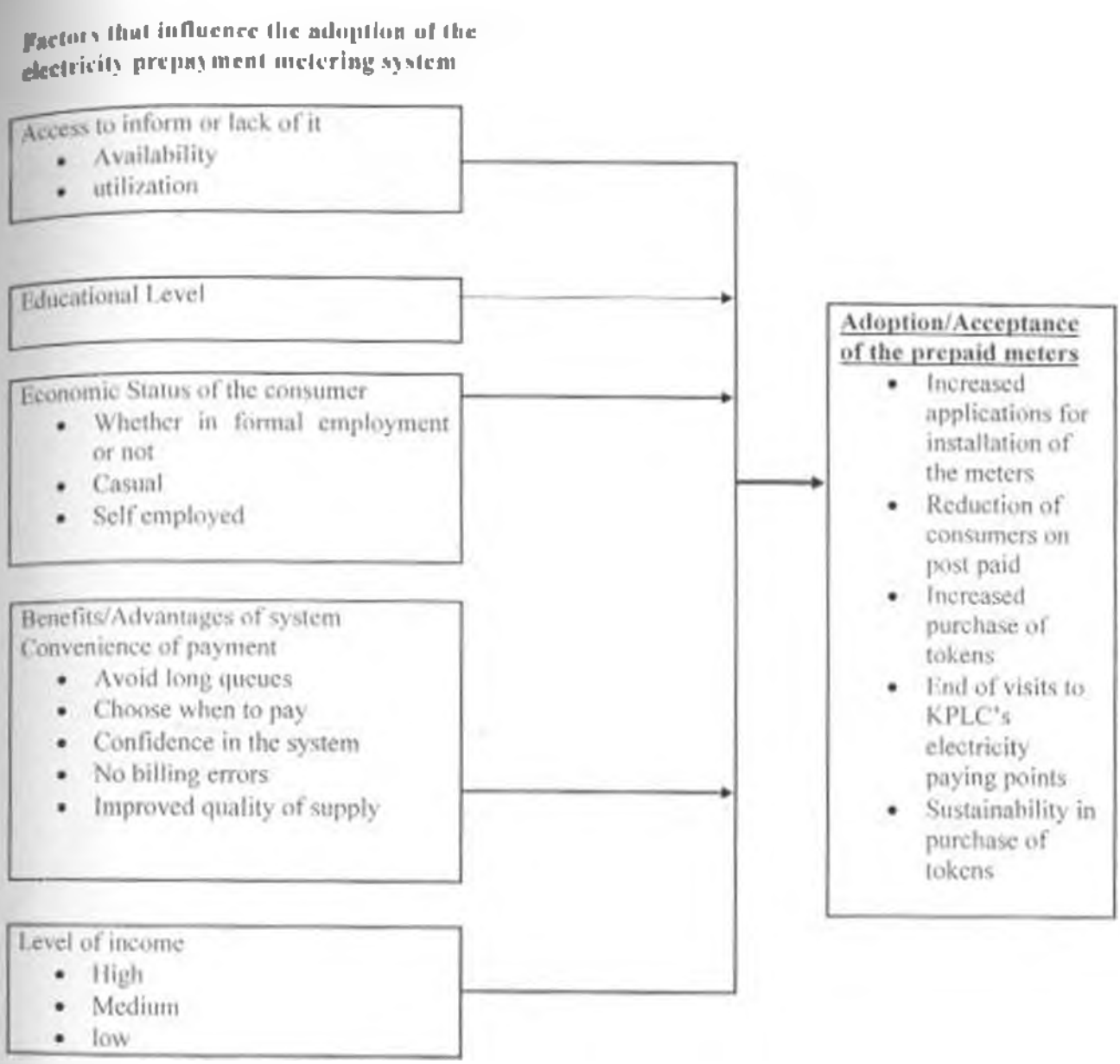


Figure 3. Conceptual framework

2.11 Conceptual Framework

The study was guided by the conceptual framework shown above. It reveals the relationship between the various variables investigated by this study. The factors that influence the adoption of the pre-paid meter paying system are the independent variables while the adoption/ acceptance of the prepaid electricity are the dependent variables. Moderating variables were such as availability of the pre-paid meters, that is the CIU and its affordability, the purchasing

power of the consumer and the speediness to which one can access or obtain tokens for re-loading. Extraneous variables – include rate of consumption in kilowatts per household per day, rate of consumption for domestic use only and rate of consumption for industrial use only. Intervening variable would be the rate (in Kenyan shillings) of the generation of electricity per hour per day.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presented the methodology used to carryout the study in order to achieve the stated objectives. The chapter gives details of the research design, the research population, research site, sample size, sample design, data collection methods as well as data analyzing. The residents of Nairobi's pre-paid pilot project were the units for analysis - mainly Makadara and Embakasi Divisions, which was the target population of 200 consumers. The respondents were 160 in total, comprising 80% of the targeted 200 consumers. Questionnaires and interviews were used during the survey and data analyzed using descriptive statistics.

3.2 Research Design

The researcher also used the Descriptive Survey design to determine the success or level of adoption based on the number of residents in the pilot phase, who had adopted the pre-paid meter paying system. This type of research was both qualitative and quantitative in nature. According to Creswell(1994), a qualitative study is defined as an inquiry process of understanding a social or human problem based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting. In this case the questionnaire targeted residents of particular estates in Makadara and Embakasi, to give their views (as they perceive holistic) about the prepayment metering system. This was achieved using the qualitative study in the form of a survey. The pilot project was just a sample of the target population therefore it was a representation of a larger population (residents of Nairobi). Qualitative research involves the study, use and collection of a variety of empirical materials, case study, personal experience, introspective, life story interview, observational, historical, interaction, and visual texts-that describe routine and problematic moments and meaning in an individuals' lives. Conversely, qualitative research methodology is used when there is a need to understand a social or human problem through pictures and words in a natural setting.

This study was also Quantitative since it was an inquiry into a social or human problem adoption of the prepayment metering system, based on testing a theory composed of variables,

measured with numbers, and analyzed with statistical procedures, in order to determine whether the predictive generalizations of the theory hold true, Cresswell (1994). Patton's (1990) view of quantitative research is that methodology relies on experimentation methods and quantitative measures for hypothetical test for generalization. It shows that this methodology is adopted to draw up hypothetical statements which are tested via numeric or quantitative experimentation and interpretation. It is a scientific approach used in natural science, suitable for researches that are investigated for test of verification, and comparison between variables. It is therefore deductive, relying on the use of hypothetical testing in its verification, via specific data

The strength of quantitative paradigms is grounded on the clearly stating of Research problems, Independent and dependent variables, Hypothetical projections of the research objective and a high reliability in data gathering from various sources of data gathering methods. Also, subjectivity of results was minimized or absolutely eliminated However, since quantitative paradigm relies heavily on the use of hypothesis, Qualitative research is an incorporated understanding of a social or human problem through pictures and words in a natural setting case of KPLC Nairobi.

3.3 Target Population

The researcher took the population of 2000 Customers (from the pilot project) from estates which had been switched to the pre-paid meter paying system by December 2009 and early January 2010 Makadara division comprised 800 customers and Embakasi division 1200 customers. The researcher's choice of divisions was based on the high successful rate in adoption of the prepayment metering system, by consumers from these divisions.

3.4 Sampling Procedure

The target of the service provider KPLC was to switch 25,000 customers to the pre-paid system by end of February 2010, but by the end of December 2009 and early January 2010 only 15317 customers had been switched to the pre paid meter paying system Gitonga (2010) Out of these, 800 were from Makadara Division and 1200 from Embakasi Division, bringing the researcher's target population to 2000 consumers. In a Descriptive survey, data is collected from a sample, Parlier (1994) explains that samples that are deterministic and descriptive in nature are deemed adequate within 10% of the target population. The whole idea of sampling is that by selecting some of the elements in a population we may draw conclusions about the

entire population (Cooper 2006). The researcher took a sample size of 200 customers which made 10% Parlier (1994) of the targeted population of 2000 customers by December 22nd 2009. The study employed use of proportional sampling procedure because the population was not homogenous. The population in the pilot estates was not evenly distributed. In this case for instance in Makadara division the researcher targeted 800 (0.1 x 800) households and in Embarkasi division 1200 (0.1 x 1200) households so as to get 10% Parlier (1994) of the targeted population which added up to 200 households.

The population was divided into strata. Items from each stratum constituted a sample. Since each stratum was more homogenous than the total population, the researcher was able to get more precise estimates for each stratum Kothari (1990) Stratification achieves greater precision when that strata has been chosen so that members of the same stratum are as similar as possible in respect of the characteristics of interest. It is also administratively convenient to stratify a sample sthe interviewers can be trained to deal specifically with a certain category of people.

Table 3.1 The stratification of the sample

	DIVISION & ESTATE	HOUSEHOLDS	(% OF TARGET POPULATION)	SAMPLE SIZE
A.	**MAKADARA DIVISION**	800	10	80
1	Golden Gate	400	10	40
2.	Plainsview	300	10	30
3.	River Bank	100	10	10
B.	**EMBARKASI DIVISION**	1200	10	120
5.	Nyayo Embakasi	600	10	60
6.	Imara Daima	400	10	40
7	Villa Franca	200	10	20
	TOTAL	2000	10	200

3.5 Methods of Data Collection

The researcher used both primary and secondary data collection methods:

Primary Data

Observation: In order to obtain data the researcher carried out field observations noting how many of the 200 customers had the pre paid meter installed in their houses. This was made

easier given that the pre-paid meter is a visible gadget (CIU) that is installed in the house. The study being qualitative in nature, observation is a methodology used in data collection.

Questionnaires:

These included structured (close-ended) and unstructured (open-ended) questions. The structured questionnaire is advantageous when it comes to obtaining of information. A researcher finds this approach to data collection useful for administrative purposes, since the questions can be followed with alternative questions and they offer alternative answers too. They are also economical in terms of time and finance. Open ended questions permit greater depth of response. With unstructured questions, a respondent may give an insight to his feelings, back ground, interests or decisions, without holding back. This is because the questions there-in are open-ended.

Interviews:

The interviews were face-to-face while others were carried out through telephone conversations and via internet by E-mail. In this case the most preferred method and the most effective was the face to-face interview by way of an interview guideline. Interviews permit a more thorough understanding of the respondents' opinions and provide a desirable combination of objectivity and depth. Interview guidelines are considered the most appropriate in studies in education (Borg 1983) hence the interview guide was designed for data collection.

3.5.1 Pilot testing the research instruments of the study

The research instruments that the researcher used were basically Observation, Questionnaires and interviews. During the observation process, the researcher was looking for the CIU which is the meter for prepayment. It is a visible gadget which could easily be identified by its features. Once identified, this was then noted down. A trial on sampled questionnaires was carried out with a few consumers. The aim was to ascertain clarity of the questions and to modify any if need arose, so as to achieve a higher response rate and with the aim of meeting the target population. Most of the interviews were carried out face to face. This was done with a formal introduction and then request for an interview. Where the consumer declined, the researcher would then leave a telephone contact or request for the consumer's e-mail address so as to mail the questions to them later. The face-to-face interviews were the most effective.

3.5.2 Validity of the instruments

Validity refers to the degree to which a test or other measuring device is truly measuring what it was intended to measure. A pretest was conducted on a population similar to the target population in order to assess the validity of the instrument. Items that were not appropriate for measuring the variables were modified or discarded to improve the quality of the research instrument. This increased its validity. In this case a small group of the population was given questionnaires to fill and any difficulties experienced taken into account then questions were amended accordingly. This assisted in knowing whether the instrument was clear, precise and comprehensive enough. After pre testing, there were amendments to the questions.

3.5.3 Reliability

Reliability is synonymous with the consistency of a test, survey, observation or other measuring device. This measure was important since it ascertained that the data collected was consistent and a representative of what was to be achieved from the research. Reliability is a measure of the degree to which a research instrument yields consistent results or data, after repeated trials (Mugenda 2003). Nachmias (1992) defines it as the extent to which a measuring instrument contains variable errors, that is errors that appear inconsistently from observation to observation during any one measurement attempt or that vary each time a given unit is measured by the same instrument. It is the degree to which an instrument will give similar results for the same individuals at different times. Conditions under which the measurement took place were standardized by ensuring that external sources of variation such as boredom and fatigue were minimized to the extent possible. This was done by creating a lively and friendly environment before carrying out the research. Carefully designed direction for measurement with no variation from group to group was established. This was done using trained and motivated persons to conduct the research. Methods of calculating reliability were such as correlation.

3.6 Operational Definition of Variables

Table 3.2 The operationalization of Variables

VARIABLE	MEASUREMENT	MEASURING SCALE	UNIT OF MEASUREMENT
Information	Knowledge of existence of new technology	Ordinal	Percentage of those informed
Level of Education	Highest level of education attained	Ordinal	Number of individuals in each category
Economic status of the consumer	If employed	Ordinal	Source of income
Benefits/Advantage of the prepaid metering system	Aware of advantages	Nominal	Number of those aware
Income level of the Consumer	Monthly income	Ratio	Number (amount)

3.7 Methods of Data Analysis

Data was analyzed using descriptive statistics which include measures of central tendency (mean, median and mode) and other statistical methods like pie chart, bar graphs and histograms which were used widely in the presentation of data. To assign meaningful responses to variables depended on the measuring scale – ordinal or nominal in response to the factors that influenced the adoption of the pre-paid meter paying system. Data was analyzed using a windows management software - Statistical package for social sciences (SPSS)

3.7.1 Data Analysis (Interview Phase)

The data gathered was analyzed based on the research instrument used to acquire information from the consumer in order to resolve the research question. For the purpose of this research, structural equation modeling was used to analyze the questionnaire administered in order to achieve an accurate, reliable gathered data.

3.7.2 Data Analysis (Survey Phase)

This were findings from data analyzed on the questionnaires distributed to Consumer/customers and with the aid of structural equation model. As described by Bogdan

and Biklen (1998), it is "working with data, organizing it, breaking it in manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others".

3.8 Summary

This chapter sought to give guidance on data collection, analysis, interpretation and presentation. The method used in data collection determined the instrument to measure the validity and reliability of that data. This gave rise to the hypothesis after data analysis and finally the conclusion, which is the researcher's recommendation.

CHAPTER FOUR

DATA ANALYSIS PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter details the presentation, interpretation and analysis of data as described in the methods. The data was analyzed and organized based on findings derived from general information (inclusive of the objectives such as access to information or lack of it, level of education, economic level, benefits/advantages of the prepaid system and income levels of the consumer. Interpretation of the data was based on the findings after analyzing the factors influencing the adoption of the electricity prepayment metering system.

4.2 Demographic Profile of Respondents

Data was gathered out of 200 questionnaires distributed for the study; however 160 respondents filled and returned the questionnaires thus representing 80% of the target population. Of the respondents, 35.25% were female and 68.75% were male. An indication that the decision to adopt or not to adopt the prepaid meter) was predominantly undertaken by the male. In terms of age majority (60%) were aged between 31 – 40 years, then between ages 20 – 30 years and above 40 years accounted for 20% each. This is as reflected in tables 4.1, 4.2 and 4.3.

Table 4.1: Age of Respondents N=160

This table indicates that majority of those who adopted the prepaid meter were aged between 31 – 40 years followed by those above 40 years they comprised 60%

Age	Frequency	Percentage
20 – 25 yrs	16	10
26 – 30 yrs	16	10
31 – 35 yrs	48	30
36 – 40 yrs	48	30
Above 40 yrs	32	20
	160	**100**

Table 4.2 below indicates that majority of the decision makers, on whether to adopt the prepaid meters, lay with the male figure - that is 62.5%.

Table 4.2: Gender of Respondents

Gender	Frequency	Percentage
Male	100	62.5
Female	60	37.5
	160	**100**

Table 4.3 below indicates that majority of those who adopted the prepaid meter were those within marriage. That was 56.25% of the population.

Table 4.3: Marital Status of Respondents

Marital Status	Frequency	Percentage
Married	90	56.25
Single	40	25
Separated	10	6.25
Widowed	20	12.5
	160	**100**

4.3 Level of Education

Depicts the fact that the level of education indeed contributed greatly to one's and receptiveness to new technology and change. Consumers of College level of education and above, that is University level, constituted 81.25% of those who adopted the prepaid meter as shown in table 4.4 below.

Table 4.4: Level of Education

Level of Education	Frequency	Percentage
Primary (class 1-8)	10	6.25
Secondary(form 1-4)	20	12.5
College (Certificate or Diploma)	30	18.75
University (Degree)	100	62.5
	160	**100**

4.4 Economic status

Reflects the economic status which indicates the source of income and the level at which it influences adoptability. As shown in table 4.5 below, most of the respondents - comprising

37.50% were employed by the civil service. They were closely followed by Private sector employees 21.88% then those employed by state corporations 18.75%, then self employed consumers were next with 12.5% then finally the casual employees comprised 9.37%. This trend showed that those employed in the civil service preferred prepaid electricity.

Table 4.5 Economic status

Source of Income	Frequency	Percentage
Self employed	20	12.5
Casual	15	9.37
Civil Servant	60	37.50
Private Sector employee	35	21.88
State Corporation employee	30	18.75
	160	**100**

4.5 Level of income

Shows that majority of the consumers with an average monthly income of between Kshs 26,000 49,000 that is 50% of the target population, were receptive to the prepaid meter. The majority of the consumers spent over 1000 Kshs on electricity, that is 68.75% as reflected in table 4.6 below.

Table 4.6 Level of income in Kshs

Average monthly Income in Kshs	Frequency	Percentage
Earning Less than 5000	15	9.37
Earning 5000 15,000	25	15.62
Earning 16,000 25,000	40	25
Earning 26,000 49,000	50	31.25
Above 50,000	30	18.75
	160	**100**

Table 4.6.1: Average monthly consumption of electricity in Kshs

Consumption in Kshs	Frequency	Percentage
paying btw 500 1000	50	31.25
paying btw 1001 - 2000	70	43.75
paying above 2000	40	25
	160	100

4.6 Prepaid Electricity - Awareness

This is an indication that there was awareness on prepaid electricity irrespective of the source of information. All the consumers had an idea on prepaid metering.

Table 4.7 Prepaid Electricity - Awareness

Source of Information	Frequency	Percentage
From the Newspaper	30	18.75
Advertisement(Television or Radio)	20	12.5
The chief or area councllor	10	6.25
KPLC employee	40	25
Road show	35	21.88
The internet	25	15.63
	160	100

4.7 Benefits/Advantages of prepaid electricity metering system

Some of the benefits or advantages derived from electricity prepayment. They include saving of electricity, households controlling their own budget, households consuming only what they can pay, households controlling their own electricity access and households not owing anybody for electricity. Improved budgeting, convenience of payment, avoiding of long queues, choose when to pay, no billing errors and confidence in the system. The majority, that is 37.5% felt that the greatest advantage of the prepaid meter was, households controlling their own electricity as reflected in table 4.8 below.

Table 4.8 Benefits/Advantages of the prepaid meters

Source of Information	Frequency	Percentage
Households control their own budget	5	3.13
Households consume what they pay for	10	6.25
Households control access to their electricity	20	12.5
Households will not owe anybody electricity	20	12.5
Improved budgeting	20	12.5
Convenience of payment	20	12.5
Avoiding long queues	10	6.25
Choose when to pay	30	18.75
No billing errors	15	9.37
Confidence in system	10	6.25
	160	100

When asked whether a prepaid meter was the best way of providing electricity, majority agreed as depicted in Table 1.9 below 62.5% agreed, 21.87% Disagreed and 15.63% were neutral

Table 4.9 Level of those who preferred prepaid electricity

Level of Acceptance	Frequency	Percentage
Agree	100	62.5
Disagree	35	21.87
Neutral	25	15.63
	160	100

Alongside the benefits of the electricity prepayment, comes the disadvantages as depicted in Table 4.10 below

Table 4.10: Disadvantages of prepaid meter

Disadvantage	Frequency	Percentage
Can not afford to buy prepaid card	15	9.8
Limited use of electrical appliances	10	25
Consumers cut off their electricity supply	20	12.5
Units purchased get finished quickly	10	6.25
Illiteracy of some consumers	5	13.3
Increases conflicts in households	10	6.5
Prepaid device rejects pin codes of "unneme" time	25	15.62
Bad customer service	25	15.62
	160	100

From the information in table 4.11, majority of the consumers were privy to the advantages of the prepayment metering system - that is 31.25%. 15.63% were informed prior to installation. It also indicates that much as the consumer would have liked to know the advantages of the prepaid meter, they would have also liked to know the disadvantages. None of the consumers was misinformed about their electricity debts.

4.11 Information on Prepaid meters

Table 4.11: Type of information on prepaid meters

How	Frequency	Percentage
Household debts and arrears would be cancelled	Nil	0
Advantages of prepaid electricity	50	31.25
Disadvantages of prepaid electricity	30	18.75
No money no electricity, households pay first	40	25
Little Information prior to installation	25	15.63
Prepaid meters is a form of privatization of service	15	9.38
	160	**100**

4.8 Observation on resistance of prepaid metering system

The disadvantages associated with the prepaid meters contributed significantly to the resistance. Issues related to delays in purchasing of tokens, lack of adequate information to the consumer, technical problems associated with prepaid meters, limited use of electrical appliances and generally what could be summed as bad customer care by KPLC, led to resistance. One of the major factors that led to adoption was the benefits of the prepayment meters. Rogers (2003) in the innovation – decision process, an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation. Therefore if an innovation does not provide a perceived advantage, any form of doubt affects the rate of adoption and the disadvantages are fodder to this. Ultimately an individual would require some persuasion to reduce uncertainty and enable them to make a decision to adopt or reject. This is what leads to adopter categories where individuals are classified either as early adopters or later adopters.

Table 4.12 Early Adopters and Late Adopters

Sample size as estate	Frequency (Early Adopters By Dec 2009)	%	Frequency (Late Adopters- from Jan 2010)	%
Goldengate	27	16.88	8	5
Plainsview	20	12.5	5	3.13
Riverbank	9	5.63	1	0.63
Embakasi Nyayo	39	24.38	6	3.75
Imara Daima	21	13.13	4	2.5
Villa Franca	13	8.13	7	4.38
	160			100

Majority of the early adopters in Makadara division were from Goldengate estate, that is 16.88%. Late adopters in Makadara were from Plainsview estate – 3.13%. In Embakasi division majority of the early adopters were from Embakasi Nyayo estate – 24.38% and the late adopters were from Villa Franca estate – 4.38%.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the findings of the study. Conclusions and recommendations on factors influencing the adoption of prepaid meters (in Makadara and Embakasi divisions) were made based on these findings

5.2 Summary of findings

Table 5.1 The findings of the study

This was based on the objectives of the study

Objective/ Variable	Main findings	Remarks
To establish how access to information or lack of it, influences the consumer's adoption of the pre-paid meter	Majority of the respondents – 53.13% got the information through advertisements (Newspapers, TV, Radio and Road shows) 25% were informed just before installation. Irrespective of the source, all the 160 had information on the prepaid meters at the time of installation	Advertisement was more effective as a means of disseminating information thus more effective in creating awareness as opposed to using provincial administrations
To establish the how level of Education of the consumer influences the adoption of the pre-paid meter	Those with college level education and above that is University, were more receptive to this technology That is 81.25%	The higher one's level of education the more receptive one is to new technology
To establish whether the economic status of the consumer influences their adoption of the new pre-paid meter	Majority of the respondents were civil service employees They comprised 17.50% Casual employees were lowest in adoptability status – 9.37%	The consumers with a more reliable or steady source of income were more receptive to the new technology as opposed to the casuals, whose source of income was unreliable
To establish whether the benefits/Advantages of the prepaid meter influences the consumer's adoption	Amongst the notable advantages, 37.5% felt that being able to control their own electricity consumption was the biggest advantage. Then no electricity debt made 25% and avoiding long queues 18.75%	The advantages of the prepaid meters served to boost acceptability as opposed to the disadvantages which only slowed down the process.
To establish whether the level of income influences the consumer's adoption of the prepaid meters	Those earning above Kshs 16,000 were the majority in adopting – 75%.	The respondents budgeted for electricity in-line with their monthly earnings

5.2.1 Discussion of findings

Discussions were based on the on the five (5) objectives of the study but also included the respondents' ages, gender, marital status and both the early and late adopters.

The study established that information led to awareness hence its' significance. The reason why the entire 160 respondents' were connected to the prepaid meter which translated to 100% effectiveness, was due to information. Notably, the means of dissemination determined the rate at which that information was accepted and retained. Advertisements catered for 53.13% of the respondents' awareness (road shows, television adverts and radio) and this was the leading means of enlightening the consumers on prepayment. Dissemination of information by provincial administrators like chiefs and councilors proved the least effective – 6.25 %. This was an indication that people required and relied on information to decide on matters concerning innovation. In Rogers' theory of innovation, the decision stage talks about diffusion of innovation, to enable people to decide whether they can accept the innovation or reject it. The way in which information is disseminated, determines the level of diffusion and ultimately acceptance.

5.2.2 Level of Education

The study established that the level of education contributed to the receptiveness of new technology; that was 81.25%, which was the highest determinant of adoptability. This aspect was followed by the age factor – 80%, where those aged above 30yrs were more receptive to the innovation. There was an indication that the lower the respondents' level of education, the less the understanding and acceptability of innovation 6.25%. It is clear that the level of education boosts adoptability.

5.2.3 Economic Status

The study also investigated whether the economic factor was likely to influence the adoptability of the prepaid meters. These factors included one's source of income such as self employment, casual employee, civil servant or private sector employee. This was a pointer towards the reliability of one's source of income. The casual employees for instance catered for 9.37% of adoptability. The civil servants were the majority with 37.5%, an indication of a more secure, steady and reliable source of income hence an indication of affordability.

5.2.4 Benefits/Advantages of the prepaid meter and disadvantages

The majority, that is 37.5% felt that the greatest advantage of the prepaid meter was, households controlling their own electricity. The advantages are a confirmation that the technology is worth being accepted. According to Rogers (2003), at the confirmation stage the individual looks for support for his or her decision. The advantages offer this support and aide an individual's decision making. Disadvantages on the other hand serve to discourage and contribute to an individual's attitude towards adoption an innovation. Much as the prepaid meters come with their disadvantages – 18.75%, given their advantages this may not be a deterrent to adoption but may only serve to slow it down. In the end this gives rise to early adopters and late adopters. 80.65% were early adopters and only 19.39% of the respondents from both divisions, were late adopters.

Majority of those connected were married that is 56.25%. Given that the decision of adoption was made by men, 62.5% then this reveals that majority of those connected were within a family setting where the head of the household is the main decision maker

5.2.5 Level of income

Those earning above 16,000 kshs were 75% of the respondents. While those who spent over 1000 Kshs on electricity were 68.75%. This was an indication that majority of the respondents earned over 16,000 kshs per month and could afford to spend over kshs 1000 per month on electricity. Given the fact that they so much yarned to control their own usage of electricity, their adoption of the prepaid meter fulfilled their quest.

5.3 Conclusions

Based on the findings, the major factor leading to adoption was access to information. Given the enlightenment the project is successful given that all the respondents adopted the prepaid meter. The level of education was the second determinant. The indication is that the higher one's level of education the better the reception to adoptability. Given that KPLC intends to role-out this project countrywide, literacy levels of the target community will be one major determinant to adoption. The higher one's income, the more sufficiently one was able to budget for their monthly electricity consumption. Fourth was the economic status of the consumer. It was observed that the more reliable the source of income of the consumer, the greater the level of acceptability. The casual employees were the least receptive. Lastly the advantages of the prepaid meters played a key role in their acceptability but disadvantages

only served in slowing down the whole process. The age factor was crucial to adoption. It was observed that majority of respondents were aged 26 years and above. Majority of those who adopted the prepaid meters were within family settings.

All factors (for and against prepaid) notwithstanding, there will always be early adopters and late adopters. Most of the users agreed that prepaid metering was the best way of providing electricity therefore the pilot project was a success.

5.1 Recommendations

5.1.1 Recommendations to KPLC policy makers

The main key to success with a target group is, making the product and marketing positioning clear. Customers would prefer the current meters as so long as they possessed adequate information about them. KPLC would therefore consider carrying out the following:

1. Develop brochures to be hand delivered to each home. They should also be handed out during community discussions.
2. Brochures should be supported with posters, to be put up at strategic points in buildings and other suitable places.
3. Presentation to the community: This may be done by presentation to a community opinion leader to explain the concept and benefits of the new service.
4. The vendor or agent must be trained on the features and benefits of the system, so that he may become a good ambassador for KPLC. He could be used to promote the service and KPLC. Brochures must be available at each agent or vendor. If possible, have some audio-visual presentation at the agent or vendor, for greater impact.
5. A 24-hour call in or help line service should be set up at KPLC and communicated in the brochures and posters.

This will enhance the general goodwill form all parties concerned, hence guarantee the smooth transition and acceptance of the new service.

5.4.2 Recommendations for further research

Since the study focused on factors influencing the adoption of prepaid meters, looking at five objectives only, the study saw a need for future research on the disadvantages of the technology. The disadvantages were a setback so ought to be addressed so as to reduce the

level of resistance. Being a pilot project feedback is very vital. KPLC may have to consider an efficient feedback mechanism like Prepayment Project suggestion boxes:

i. On-line suggestion box (for those on e mail).

ii. Suggestions by written or computer box (for those not on e-mail)

With such a measure in place, it is easier to correct and improve on an innovation. Mitigating against those challenges would enhance development For instance with the introduction of the scratch card model of purchasing electricity, all levels of income earners will be considered hence creation of an enabling environment for electricity access.

REFERENCES

Act in Sociology: A Theoretical Introduction to Sociological method, 297-313, New York, McGraw-Hill.

Agarwal, R and Prasad (1998); A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology Information Systems Research, Volume 9, Issue, pp. 204-215.

Alreck, P.L. and Settle, R.B. (1995); The Survey Research Handbook: Guidelines and

Anderson, T., Varnhagen, S., & Campbell, K. (1998); Faculty adoption of teaching and learning technologies: Contrasting earlier adopters and mainstream faculty. The Canadian Journal of Higher Education, 28(23), 71-78.

Asika, N. (1991); Research Methodology in the Behavioural Sciences. Longman Lagos, Nigeria

Bennett, J., & Bennett, L. (2003); A review of factors that influence the diffusion of innovation when structuring a faculty training program. Internet and Higher Education, 6, 53-63.

Blankenship, S.E. (1998); Factors related to computer use by teachers in classroom instruction (Doctoral Dissertation, Virginia Polytechnic Institute and State University, 1998). Pro Quest Digital Dissertations (UMI No. AAT 9831651).

Bodgan, R.C. and Biklen, S.K (1998); Qualitative Research In Education: An Introduction to Theory and Methods. (3rd edition) Allyn and Bacon A Viacom Company, Needham Heights, USA.

Cassell, C. & Symon, G. (1994); Qualitative Research in work contexts. In C. Cassell, & G. Symon (Eds.), Qualitative methods in organizational research (pp. 1-13).

Cassell, C. & Symon, G. (1994); Qualitative Research in work contexts.

Castells, M (1996); The Rise of the Network Society: The Information age, Economy, Society and Culture. Blackwell publishers, Inc. Cambridge, MA, USA.

Castillo, Joan Joseph (2009); Non-probability Sampling. Retrieved 24/01/2010 from Experiment Resources: resources.com/nonprobabilitysampling.html

Chava Frankfort Nachmis, David Nachmias(1996); Research methods in social sciences. London. Arnold

Davenport, T (1993); Process Innovation: Re-engineering work through Information Technology. Harvard Business School press. Boston, Massachusetts, USA

Davis, F.D (1989); Perceived Usefulness, Perceived Ease of Use and User acceptance of Information Technology. MIS Quarterly, Vol.13, No. 3, pp. 319-340

Delone, W.H and Mclean, E.R (1992). The Quest for the Dependable Variable. Information Systems Research, vol. 3 Issue 1, pp. 60

Denzin, N.K and Lincoln, V.S. (1994); Competing paradigms in Qualitative Research Handbook of Qualitative research.

Dutton, J.E and Dutcrich, J.M. (1991); Keeping an Eye on the Mirror: Image and Identity in Organizational Adaptation. The Academy of Management Journal Vol 34, No. 3, pp. 517-54.

Easterby-Smith, M., Thorpe, R and Lowe, A. (2000); Management Research: An Introduction. Sage Publications Ltd. London.

Evans, P.W and Wruster, T.S (1997); Strategy and the New Economics of Information. Harvard Business Review, No.5, pp. 71-82.

Fink, A. (1995); How to ask survey questions. Thousand Oaks, CA: SAGE Publications.

Fryer, D. (1991); "Qualitative methods in occupational psychology: Reflections upon why they are so useful but so little used", The Occupational Psychologist, 11 (Special issue on qualitative methods), 3-6.

G. Symon (Eds.); Qualitative methods in organizational research (pp. 1-13). Thousand Oaks, CA: Sage Publications.

Galbriath, J R (1973); Designing Complex Organizations Addison-Wesley, Longman Publishing Co. Inc. Boston, MA.USA.

Gitonga Rosemary (2010); Report on the review of prepayment pilot project.

Gorman, G.E. and Clayton, P. (1997; Qualitative Research for the Information Professional: A Practical Handbook. Library Association Publishing.

Cooper, D and Schindler, P. (2006). Business research methods. Boston: McGraw-Hill.

http://www.kplc.co.ke/

Kothari, C R (1990). Research methodology: Methods and techniques. New Delhi: New Age International (P) Limited

Kothari, C R (Dr). (2004); Research methodology methods and techniques. (2nd Rev ed.). New Age International Publishers Ltd.

Mugenda O. and Mugenda A. (2003); Research Methods: Quantitative and Qualitative approaches. Nairobi ACTS PRESS

Nachmias, F. (1992); Research methods in the social sciences. London: St Martins press

Osuagwu, L. (2006); Business Research Methodology: Principles and Practice. 3rd edition.Grey Resources, Lagos, Nigeria.

Patton, M Q (1990); Qualitative Evaluation and Research Methods (2nd ed.). Newbury Park, CA: Sage Publications, Inc.

Proceedings of the Academy of Information and Management Sciences, Volume 13, Number 2 Las Vegas, 2009

Rd to Theory and Methods. (1 edition) Allyn and Bacon. A Viacom Company, Needham Heights, USA.

Rogers, I M (2003), Diffusion of innovations (5th ed.) New York: Free Press.

Strategies for Conducting a Survey. (2nd edition). New York: Irwin Professional Publishing

The Turkish Online Journal of Educational Technology TOJET April 2006 ISSN 1303-6521 volume 5 Issue 2 Article 3

Thousand Oaks, C A: Sage Publications. Denzin, N.K and Lincoln, V.S. (1994) Competing paradigms in Qualitative Research. Handbook of Qualitative research.

Trochim, William M.K., (2006). Research Methods Knowledge Base. Retrieved 24/01/2010 from: http://www.socialresearchmethods.net/kb/sampnon.php Page 27

APPENDICES

Appendix 1: Letter of transmittal

Ms Violet Mukosi Simiyu
P.O Box 308 00515
Buruburu - Nairobi
12th April 2010

Dear Respondent,

I am a student at the University of Nairobi, College of Education and external studies - school of continuing and distance education: Department of extra mural studies, pursuing Master of Arts in project Planning and Management. I am carrying out a research entitled 'The factors that influence the adoption of pre-paid electricity through the prepayment metering system: A case study of Makadara and Embakasi Divisions Nairobi province, Kenya.'

The purpose of the study is to investigate the factors that would influence the residents of Nairobi in their adoption of the Electricity Prepayment Metering system. The findings of the study are geared towards to creating awareness, with the intent of motivating domestic consumers of electricity to adopt the new pre paid electricity system. This technology will help the consumer/customers to manage their power budgets, avoid disconnection for non-payment of bills and also help them avoid queuing to pay their bills over the counter," at KPLC"s banking halls.

KPLC will benefit by decongesting its banking halls, collecting its revenue upfront as well as reducing its operational costs of disconnection, reconnection and meter reading indeed for the customer, this will translate into better services aimed at customer satisfaction. Once the study is complete, the results will be shared. Any information given will be treated with confidentiality. You do not have to write your name on the questionnaire
Kindly complete the attached questionnaire and return it as soon as you complete answering the questions herein. Thanking you in advance.

Yours faithfully,

Violet M. Simiyu

Appendix 2:

Questionnaires on factors influencing the New Pre-Paid Electricity meter

1 Verify housing type by observation

One, two or three bedroom	
Flat	
Bungalow	
Mansionette	
Self built house	

*NOTE: Tick where appropriate

2. Age:

Between 20-25	
26 -30	
31 35	
36- 40	
Above 40	

3. Gender

Male	
Female	

4. Marital Status

Married	
Single	
Separated	
Widowed	

5 Level of Education – what is your highest level of education

*NOTE: Indicate the class or form

Primary School Education	
Secondary School Education	
Completed College	
Completed University	

6. Economic status – please indicate source of income

Self Employed	
Casual Employee	
Employed in the civil service	
Private Sector Employee	
Employed by State Corporation	

7. On average, how much does your household pay per month for electricity?

Specify amount	
Range	
Does not pay	
Don't know	

8. Level of income Please estimate the total income per month received from all sources by whoever meets the pre-paid electricity in the household after tax and deductions. This includes salaries, pensions, business, rental units, wages, and money from any form of informal employment.

Less than 5000 Kshs	
Between 5000 – 15,000 Kshs	
Between 16,000 – 25,000 Kshs	
Between 26,000 – 49,000 Kshs	
Kshs 50,000 and above	
Refused to disclose	
Don't know	

*NOTE: Answer "YES" or "NO" where applicable

Prepaid electricity

10. Had you ever heard of prepaid electricity?

Yes		When	
No		No electricity connection	

11. Do you have a prepaid electricity meter in your home now?

Yes	
Prepaid was removed	
Don't know	

12. Did your household apply for a prepaid electricity meter?

Yes		When?	
No		Don't know	

13. [If the answer to Q12 was "no" but a prepaid meter was installed in your household] What could be the reason?

Installed without the knowledge of the household head	
Installed during the absence of the householders	
Household was not given a choice	

Household was cohersed (read cheated) into acceptance of prepaid meter	
Prepaid meter not installed	
Don't know	
Other (specify)	

14. Please tell me if you agree or disagree with the following statement.

"*A prepaid meter is the best way of providing electricity for our household*"

*Please give a short explanation		
Agree		
Neutral		
Disagree		

15. What do you think are the advantages of using prepaid electricity meters for your household? Answer YES or NO then give a short explanation

It will save electricity		
Households can control their own budget		
Households consume what they pay for		
Households can control their own electricity access		
Households will not owe anybody for electricity		
Don't know		
No advantage		
Other (specify)		

16. What do you think are the disadvantages of using prepaid electricity meters for your household?

*Please give a short explanation		
Cannot afford to buy prepaid card		
Limited use of electrical appliances		
Consumers cut off their own electricity supply		
Units purchased get finished quickly		

Illiteracy of some consumers		
Increases conflicts within households		
Prepaid device rejects pin codes for ume me time		
Bad customer service		
No disadvantages		
Other (specify)		

Consultation

17. Who first consulted/informed households and customers about the provision of electricity through prepaid meters?

KPLC		Don't know	
Area Chief		Other(specify)	

18. How were prepaid meters explained to you?

*Please give a short explanation		
Households debts and arrears would be cancelled		
Households would be able to control their own electricity consumption		
Households pay before they use electricity		
No money, no electricity		
Households to pay a fixed rate for prepaid for the whole month		
No information		
Prepaid meters is a form of privatization of service		
Don't know		
Other (specify)		

19. What kind of information do you think KPLC should have given households about prepaid electricity meters?

No money, no electricity	
Household debts/arrears would not be cancelled	
Prepaid allows limited use of electrical appliances	
Backyard rooms – Servants Quarters, will need to have own prepaid meters	
Provide information on advantages and disadvantages	
Don't know	
Other (specify)	

20. Why do you think there could be resistance to prepaid electricity meters?

Delays in purchasing of Tokens	
Installation of prepaid meters against the will of households	
Lack of adequate information to consumers on prepaid meters	
Cut-offs brought by prepaid meters	
Technical problems associated with prepaid meters	
Limited use of electrical appliances	
Bad customer care by KPLC	
Debts and arrears that were not cancelled	
Don't know	
Other (specify)	

Appendix 3:

Interview Guideline

1) Name and location of the Estate

2) When did you first hear of the prepaid meters – pre-paid electricity?

3) Brief history of the experiences you have had with KPLC when it comes to settling of your electricity bill

4) Where do you purchase your tokens from or how do you usually top -up?

5) How many times do you top-up in a month?

6) Is your household aware on how to conserve electricity?

7) What electrical appliances do you use in your house daily?

8) What type of bulbs do you have?

9) What is your experience with the pre-paid electricity – what do you like about it and what don't you like?

10) What is the best experience, in your view about the pre-paid?

11) What is the worst experience, in your view about the pre-paid?

12) What are your recommendations on pre-paid electricity?

ENDIX IV

USER GUIDE

PRE-PAID POWER

PRE-PAID ELECTRICITY COMES TO KENYA

KPLC now gives you the power to control your electricity consumption with pre-paid power. With a pre-paid meter, paper bills, disconnections and the hassles of reconnections are things you'll never have to deal with. You can now buy a credit slip from any authorised vendor or through your mobile phone.

QUESTIONS ABOUT PREPAID

HOW CAN I GET A PRE-PAID POWER METER?

At the moment KPLC has preselected the project sites to be converted from the traditional meter to prepayment e.g. [illegible], Nyayo Highrise just to mention a few. KPLC will meet the cost of prepayment meter installation for the project phase.

IS PRE-PAID CHEAPER THAN WHAT I PAY NOW?

No the charges will be the same – refer to the tariff schedule. The only difference is that with prepayment, you will be paying in advance.

WILL MY ELECTRICITY BE SHUT OFF WHEN THE CREDIT RUNS OUT?

Yes, your electricity will be shut off (disconnected) when your credit runs out. However, the meter will give [illegible] before it [illegible]. When faced with this situation it is advisable to top up your credit so as to avoid disconnection.

HOW DO I OBTAIN A CREDIT?

You may obtain credit from existing KPLC pay points e.g. Electricity House and Stima Plaza, plus other 3rd party vendors such as Uchumi, Zain and Safaricom (M-Pesa) so as to improve purchase convenience to the customer.

IF I HAVE AN OVERDUE BILL, WILL MY ELECTRICITY BE SHUT OFF WHEN THE TECHNICIAN COMES TO INSTALL THE NEW METER?

No, your electricity will not be shut off. However, you should endeavour to clear the debt prior to conversion, otherwise the [illegible] will be transferred to the prepayment system. If the transfer occurs, on subsequent purchase of electricity, a portion of your payment will be deducted and used to reduce the amount.

ONCE THE NEW METER IS INSTALLED, WILL THE KPLC TECHNICIANS STILL COME TO READ MY METER?

No, meter reading [illegible] necessary in prepayment metering system. However, our KPLC technicians will be visiting customer premises from time to time to carry out inspections as required by law.

HOW WILL THE KPLC TECHNICIAN BE IDENTIFIED?

KPLC technicians will come in a team and bear a company identification card. He will also have a [illegible] which will be used to replace the existing [illegible] meter.

WILL THE METER AFFECT MY GEYSER, HOT WATER?

No, the meter will not affect [illegible].

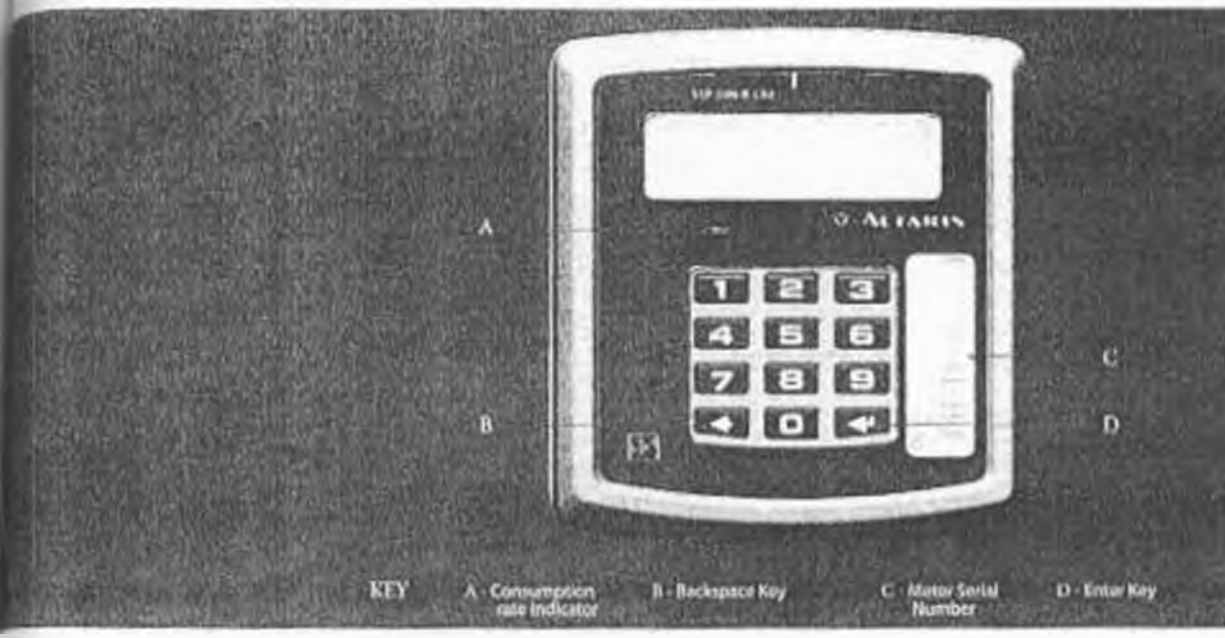
WHAT HAPPENS TO MY CURRENT ELECTRICITY DEPOSIT?

[illegible] electricity deposit will be refunded if you have no debt.

HOW MUCH POWER CAN I BUY?

You can buy as [illegible] you wish.

THE PRE-PAID METER



UNDERSTANDING THE UNIT'S SCREEN

- Load Connected
- Entry Rejected
- No Load
- Load Disconnected
- Entry
- Lock Out Condition
- Processing
- Low Credit Warning / No Credit
- Power Level Indicator

WHERE TO BUY PRE-PAID ELECTRICITY

Purchasing a token

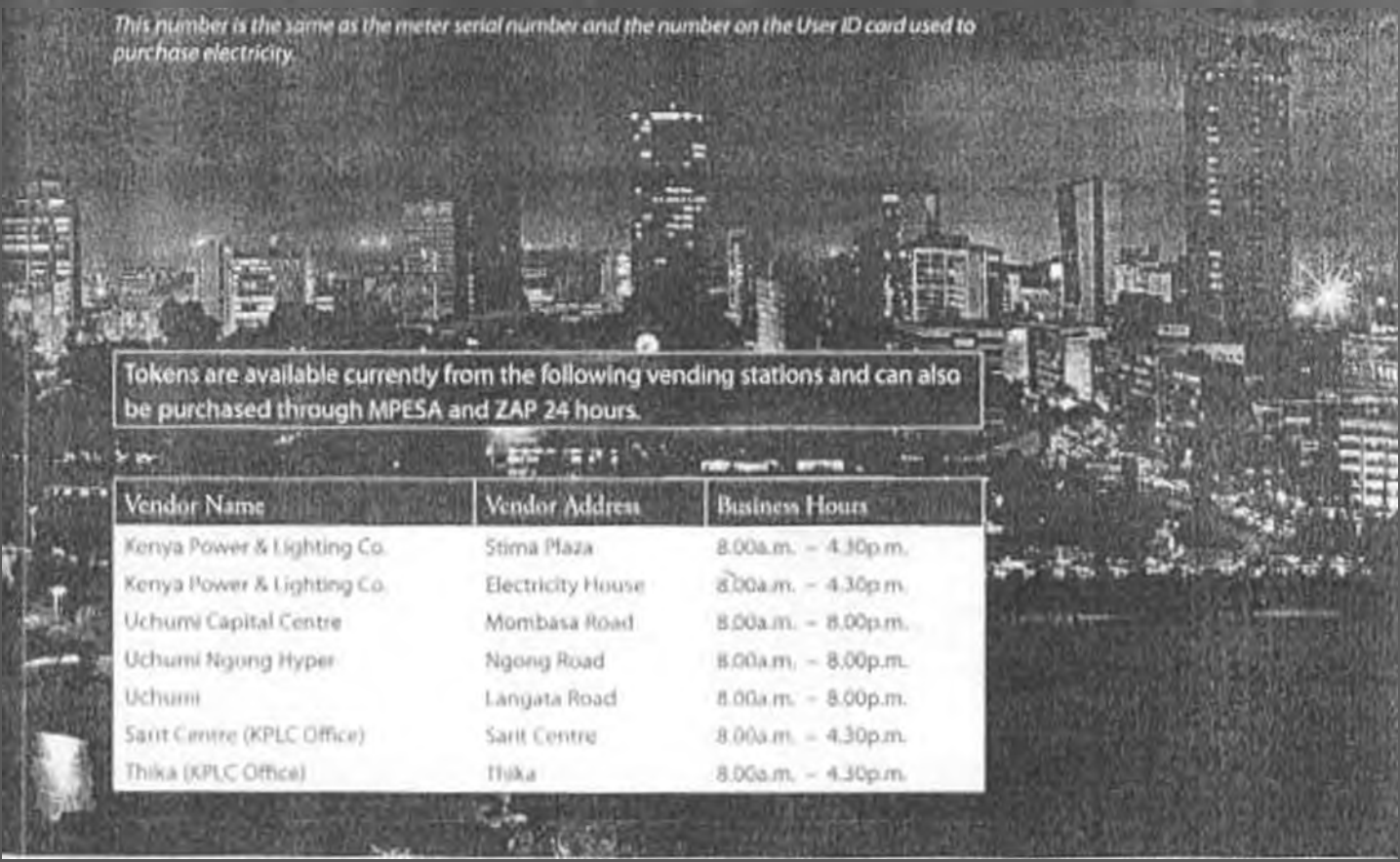
1. Go to the local electricity vendor.
2. Supply the operator at the vendor with the meter ID card or meter serial number.
3. Supply the operator with the amount you wish to purchase.
4. You will receive a 20-digit token printed on a receipt.

Note:

To display the meter serial number, key in '100' followed by the 'Enter' key.

The meter will display the 11-digit meter serial number, scrolling from right to left (twice).

This number is the same as the meter serial number and the number on the User ID card used to purchase electricity.



Tokens are available currently from the following vending stations and can also be purchased through MPESA and ZAP 24 hours.

Vendor Name	Vendor Address	Business Hours
Kenya Power & Lighting Co.	Stima Plaza	8.00a.m. – 4.30p.m.
Kenya Power & Lighting Co.	Electricity House	8.00a.m. – 4.30p.m.
Uchumi Capital Centre	Mombasa Road	8.00a.m. – 8.00p.m.
Uchumi Ngong Hyper	Ngong Road	8.00a.m. – 8.00p.m.
Uchumi	Langata Road	8.00a.m. – 8.00p.m.
Sarit Centre (KPLC Office)	Sarit Centre	8.00a.m. – 4.30p.m.
Thika (KPLC Office)	Thika	8.00a.m. – 4.30p.m.

"Always remember to have your 11 digit meter number when you need to buy more credit for your pre-paid meter."

HOW TO PURCHASE THROUGH YOUR MOBILE PHONE

Purchasing pre-paid electricity token via MPESA is as simple as using your phone. You will receive a return SMS that contains the token number which you enter into the meter. When the electricity credit is used, dully you purchases more credit.

THROUGH MPESA

Step 1
Go to **MPESA** menu select "**pay bill**"

Step 2
Enter the **KPLC** prepaid business number **888880** and press **OK**

Step 3
Enter the 11 digit pre-payment meter number that you would like to purchase a token for and press **OK**

Step 4
Enter the amount you wish to purchase electricity token (between KShs. **250** and **35,000**) and press **OK**

Step 5
Enter your **M-PESA PIN** and press **OK** Confirm that all the details are correct and press **OK**

Step 6
You will receive a confirmation **SMS** from **MPESA** immediately. **KPLC** will then generate a token for your meter and send it to you via sms.

THROUGH ZAP

Step 1
Go To Zap Menu

Step 2
Choose Money Option

Step 3
Choose the Nickname option & enter MYPOWER

Step 4
Enter amount

Step 5
Confirm transaction

Step 6
Enter the 4 digit password

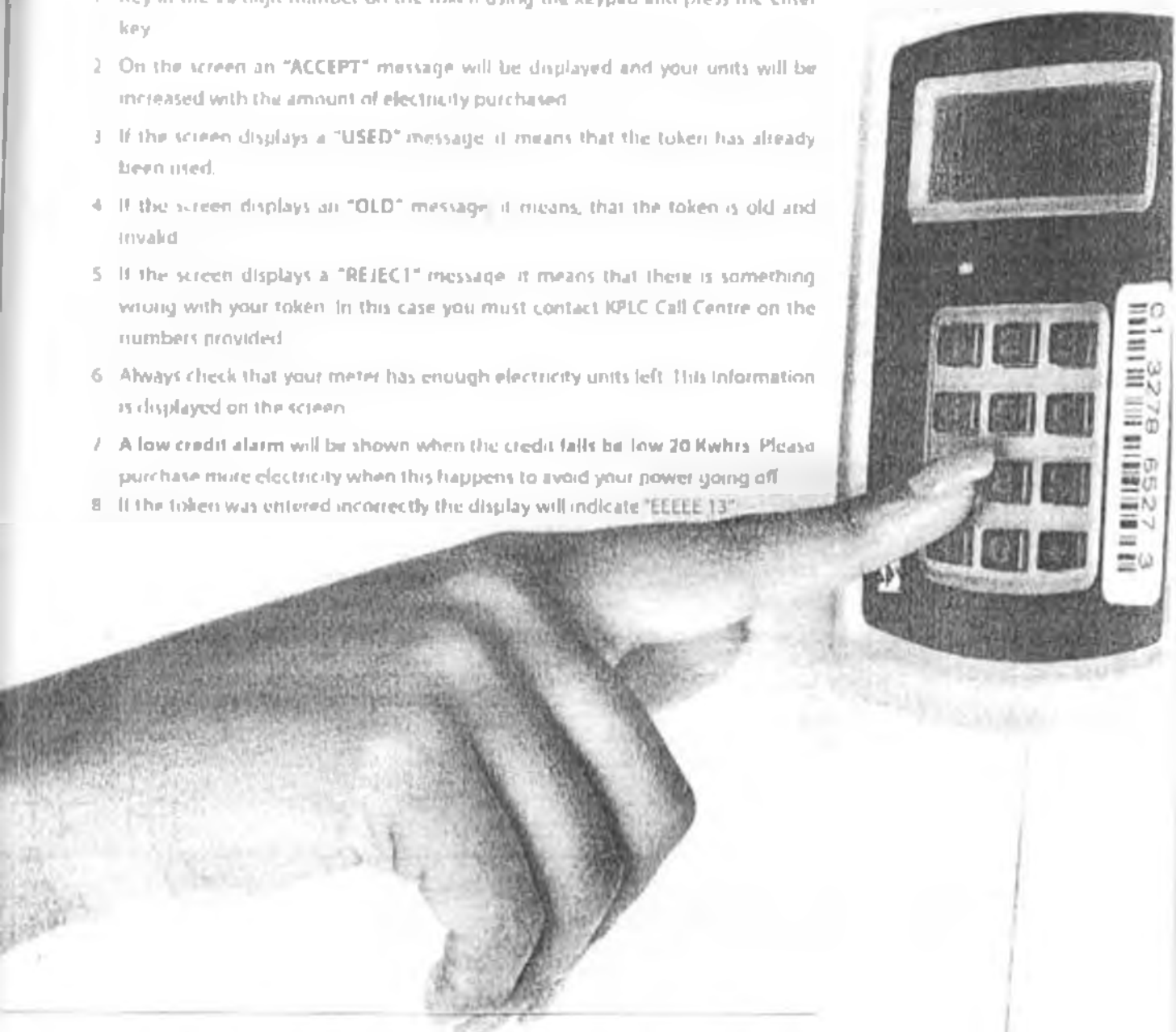
Step 7
Under reference option enter the full KPLC prepaid 11 digit meter number.

The customer will receive a confirmation SMS with the following attributes

1. *Transaction ID – which is unique for every transaction.*
2. *Amount paid*
3. *KPLC prepaid meter number*
4. *Customers Zap balance.*

HOW TO LOAD YOUR TOKEN

1. Key in the 20 digit number on the token using the keypad and press the enter key
2. On the screen an **"ACCEPT"** message will be displayed and your units will be increased with the amount of electricity purchased
3. If the screen displays a **"USED"** message it means that the token has already been used.
4. If the screen displays an **"OLD"** message it means, that the token is old and invalid
5. If the screen displays a **"REJECT"** message it means that there is something wrong with your token. In this case you must contact KPLC Call Centre on the numbers provided
6. Always check that your meter has enough electricity units left. This information is displayed on the screen
7. **A low credit alarm** will be shown when the credit falls **be low 20 Kwhrs**. Please purchase more electricity when this happens to avoid your power going off
8. If the token was entered incorrectly the display will indicate "EEEEE 13"



Over Power: Top bar of the power icon flashes. Switch off some appliances. Disconnection occurs if the Over Powe condition persists for more than 10 seconds. Reconnection will take place after 2 minutes.

Over Power Lock-out: All bars of the power icon flash. The meter has entered a lock-out condition due to five trip conditions within a 30-minute period. The duration of the lock-out is 30 minutes. The countdown displays in minutes and then in seconds for the last minute.

Meter has gone into Error mode. Please contact the supply authority.

Communication with metering unit is in progress. Please wait a few seconds.

SHORT CODES

- Display meter number/serial - 100 enter
- Display total KWh consumed - 004 enter
- Display the maximum power limit setting - 007 enter
- Display the meter instantaneous power consumption - 050 enter

CODE REFERENCE

This indicates zero credit available on the meter. Enter a new credit token for additional credit.

A 100kWh token was accepted.

Normal credit mode display.

The token was either entered incorrectly or not intended for this meter and could not be decoded by the meter.

The token that was entered is old and cannot be accepted.

The token [illegible] has been used before and

GUIDE TO PREPAID TARIFFS

NB: This tariff is applicable to post paid customers as well as the prepaid ones; and the charges are the same.

CHARGES IN TARIFF DC (Domestic Consumers)

a) A Monthly Fixed Charge of KSh 120.00*
b) Energy charges of
- KSh 2.00 per Unit for 0 - 50 Units bought,
- KSh 8.10 per Unit for 51-1,500 Units bought,
- KSh 18.57 per Unit for Units bought above 1,500

** Unit stands for Kilowatt-Hour (kWh)*

** If Tariff DC (Domestic Consumers) is used in conjunction with Method IT (The Interruptible) in the case DO (Water Heating meter) at the same supply terminals, then the combined Fixed Charge for both Methods of Charge shall be KSh 240.00*

TAXES & LEVIES

The customer shall pay any taxes, levies or duties imposed from time to time by the Government. At present, the following are levied by the Government

i VAT* at 12% charged to:
   a) Fixed Charge
   b) Demand Charge (not applicable to domestic customers)
   c) Foreign Exchange Fluctuation Adjustment
   d) Fuel Cost and,
   e) Inflation Adjustment
   f) Taxable value of electrical energy consumed in a manner required by the Government
ii Rural Electrification Programme (REP) levy at [illegible] of revenue from Unit sales.
iii Energy Regulatory Commission (ERC) levy at 3 Kenya cents/kWh

**** Fifth Schedule of Value Added Tax Act Cap 476 exempts VAT on supply of electrical energy to a domestic household where the consumption does not exceed two hundred kilowatt hours (units).***

WHAT YOU SHOULD KNOW ABOUT VAT!

As per the Fifth Schedule of the Value Added Tax Act Cap 476
"VAT shall be exempt in the supply of electrical energy to a domestic household where the consumption does not exceed two hundred kilowatt hours (200kWh)"

WHAT HAPPENS WHEN YOU EXCEED 200 UNITS IN A MONTH?

VAT charges shall be levied on all the electrical energy (units) bought from the beginning of the month.

WHAT YOU SHOULD KNOW ABOUT TARIFF DC

- Tariff DC is a step tariff and two tokens of the same amount may not give you the same number of units depending on the step you are in amongst other factors
- KPLC's vending system is online hence the system keeps a record of all previous purchases and is then able to determine the appropriate step in the tariff calculation

TYPICAL TARIFF DC (DOMESTIC CONSUMERS) TRANSACTIONS OF A CUSTOMER WHO PURCHASES TOKENS 4 TIMES IN A MONTH

1st buy in a month

Charge	Rate
Fuel	[illegible]
Forex	[illegible]
Inflation	[illegible]
REP	5%
ERC	0.01
VAT	[illegible]
Total Kwh for the month	[illegible]

Concept	Charges
Fixed Charge	120.00
Total Kwh (33.3X2)	66.60
Fuel Index Charge (Ksh7.83/kwh) i.e. 7.83X33.3	260.74
Forex Charge (Ksh 0.94/kWh) i.e. 0.94X33.3	31.30
Inflation Adjustment (Ksh 0.08/Kwh) i.e. 0.08X33.3	2.66
REP Charge (5%) i.e. 0.05X666.50	33.33
ERC Charge (Ksh 0.03/kWh) i.e. 0.01X133.3	1.00
VAT (12%) i.e. 0.12X120	14.40
Total Cost	500.00

2nd buy in a month

Charge	Rate
Fuel	7.83
Forex	0.94
Inflation	0.08
REP	5%
ERC	0.03
VAT	12%
Total Kwh for the month	97.00

Concept	Charges
Fixed Charge	0.00
Total Kwh (16.7X2)+(47.0X8.1)	414.10
Fuel Index Charge (Ksh/7.83/kwh) i.e. 7.83X63.7	498.77
Forex Charge (Ksh 0.94/kWh) i.e. 0.94X63.7	[illegible]
Inflation Adjustment (Ksh 0.08/Kwh) i.e. 0.08X63.7	5.10
REP Charge (5%) i.e. 0.05X414.10	20.71
ERC Charge (Ksh 0.03/kWh) i.e. 0.01X63.7	1.91
VAT (12%) i.e. 0.12X0	0.00
Total Cost	1,000.00

	3rd buy in a month		Concept	Charges
harge	Rate		Fixed Charge	0.00
			Total Kwh 28.8X8.10)	
	7.83		Fuel Index Charge (Ksh 7.83/kwh) i.e. 7.83X28.8	225.50
	0.94		Forex Charge (Ksh 0.94/kWh) i.e. 0.94X28.8	27.07
	0.08		Inflation Adjustment (Ksh 0.08/kWh) i.e. 0.08X28.8	2.30
	5%		REP Charge (5%) i.e. 0.05X233.28	
	0.03		ERC Charge (Ksh 0.03/kWh) i.e. 0.03X28.8	0.86
	12%		VAT (12%) i.e. 0.12X0	0.00
			Total Cost	500.00
tal Kwh for e month	125.80			

	4th buy in a month		Concept	Charges
harge	Rate		Fixed Charge	0.00
			Total Kwh (75.2X8.1)	609.12
	7.83		Fuel Index Charge (Ksh 7.83/kwh) i.e. 7.83X75.2	588.82
	0.94		Forex Charge (Ksh 0.94/kWh) i.e. 0.94X75.2	70.69
	0.08		Inflation Adjustment (Ksh 0.08/Kwh) i.e. 0.08X75.2	6.02
	5%		REP Charge i.e. 0.05X609.12	30.46
	0.03		ERC Charge (Ksh 0.03/kWh) i.e. 0.03X75.2	2.26
	12%		VAT (12%) i.e. 0.12X0 (151x8.1)+ (7.83x201)+(0.94x201)+(0.08x201)]	372.23
			Total Cost	1,680.00
tal Kwh for e month	201.00			

Total Cost for the month(1st buy+ 2nd buy+ 3rd buy+ 4th buy)= 3,680.00

POST PAID CUSTOMER TRANSACTIONS BILLED ONCE A MONTH

Charge	Rate
Fuel	7.83
Forex	0.94
Inflation	0.08
REP	5%
ERC	0.03
VAT	12%

Concept	Charges
Fixed Charge	0.00
Total Kwh (50x2.00)+(151x8.10)	1,323.10
Fuel Index Charge (Ksh7.83/kwh) i.e 7.83X201	1,573.83
Forex Charge (Ksh 0.94/kWh) i.e. 0.94X201	188.94
Inflation Adjustment (Ksh 0.08/Kwh) i.e 0.05X201	16.08
REP Charge (5%) i.e 0.05X1,323.10	66.16
ERC Charge (Ksh 0.03/kWh) i.e 0.03X201	6.03
VAT (12%) i.e 0.12X((151x8.11+(50x2)+(7.83x201)+(0.94x201)+(0.08x201))	386.61
Total Cost	3,680.00

For emergency assistance call:
020 3201000, 0711 031000, 0732-111000.
www.kplc.co.ke