CUSTOMER PERCEPTION AND ACCEPTABILITY ON THE USE OF PREPAID METERING SYSTEM IN ACCRA WEST REGION OF ELECTRICITY COMPANY OF GHANA

by

Quayson-Dadzie, John

(PG 4163610)

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DECLARATION

I hereby declare that this submission is my own work towards the Executive Masters of Business Administration and that, to the best to my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

John Quayson-Dadzie (PG 4163610)	…….	.....……
Student Name & ID	Signature	Date

Certified by:

Mr. Nicholas Apreh Siaw	.....	.....
Supervisor	Signature	Date

Certified by:

Prof. I. K. Dontwi	.....	.....
Dean, IDL	Signature	Date

DEDICATION

I wish to dedicate this research work to my children, Marcella, Michael, Thelma, Sweetie, Jojo and the whole family for the inspiration and support they gave me to accomplish this work.

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ABSTRACT

The study examined customers' perception and acceptability on the use of Prepaid Meter in Accra West Region of ECG. The main aim of this study was to improve customer acceptability by determining the level of acceptability of Prepaid Meters, analyse the factors customers considers before accepting the use of Prepaid Meters, and determine management strategy in promoting prepaid usage. Research design adopted for the study was the descriptive method. Both primary and secondary sources of data were used with questionnaire as the main instrument for collecting primary data on customer acceptability, factors customers perceive before accepting the use of prepaid meters. The stratified sampling method was used to categorise customers into the type of tariff whether domestic or commercial. A total sample size of 391 were drawn out of 18,000 customers in a district. One of the major findings of the study is that customers consider a number of factors before accepting the prepaid meter for use and these include user friendliness of the prepaid meter, durability of the prepaid meter and access to prepaid meter vending points. It is therefore being recommended that management should consider improving durability and access to prepaid meter vending points in order to improve customer acceptability on the use of prepaid meters.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The social dimension of utility reforms in less developed countries involves at least two clearly related problems. The first is to improve access to infrastructure services, a challenge that has spurred industry restructuring, private sector involvement and consequential regulatory reforms.

The second challenge, which originates in the economic efficiency goal of establishing cost-reflective tariffs, is to ensure that consumers can afford the cost of utilities services. These concerns have motivated firms and regulators to identify technological and regulatory options aimed at encouraging access and making easier for consumers to pay for their services. In both cases, Latin America has pioneered the adoption of innovative mechanisms. In the first case, higher access rates have been encouraged with the identification and imposition of connection targets, the creation of community involvement and micro credit programs, and the use of new technologies. In the second case, higher levels of affordability have been sought for with the use of instruments that ease the burden of bills via cost and tariff cutbacks and the introduction of alternative payment means.

Indeed, most of the efforts oriented towards securing higher levels of affordability have consisted of mechanisms aimed at reducing the cost of services, either by affecting their quality or by reducing their demand.

Other efforts have been targeted, however, towards the adoption of various subsidy schemes, either directly or through tariff structures (Gómez-Loboand Contreras, 2004). In

general, experiences with policies that adopt alternative payment methods for utilities have been scarce. The simplest alternative, which is often suggested, consists of increasing the frequency of billing to low income users. However, a disadvantage of this mechanism is that it would increase administrative collection costs, which would ultimately result in higher tariffs (Estache et al. 2000).

Over the last few years, however, prepayment meters either in electricity, water or piped gas have been proposed as an innovative solution aimed at facilitating affordability and reducing utilities' cost. This mechanism essentially requires that users pay in advance for the delivery of goods or services, before their consumption. In this way, consumers hold a credit and then use the service until the credit is exhausted. Prepayment systems was introduced for the first time in South Africa though on the small scale but are now widely used in the UK, Turkey India, Ghana and all over the world (Tewari and Shah, 2003). The use of the prepayment meter is still controversial despite many years of usage.

The Electricity Company of Ghana Limited (E.C.G.) was incorporated under the Companies Code, 1963 (Act 179) in February 1997 and succeeded the then Electricity Corporation of Ghana which was set up in 1967 by the Government (NLCD 125). Its mandate is to distribute electric power in Ghana. Currently, the company distributes electric power in Western, Central, Greater Accra, Eastern, Volta and Ashanti regions of Ghana. The Northern Electricity Distribution Company which used to be part of the Volta River Authority distributes electric power in Brong Ahafo, Northern, Upper East and Upper West regions of Ghana.

Electricity Company of Ghana recognizes the fact that revenue is the lifeblood of the organization and therefore there is no gainsaying that the survival of the Electricity Company of Ghana hinges on effective and vigorous revenue mobilization. However, revenue mobilization starts with effective and accurate metering, production of error free bills and effective collection exercises (ECG Report, 2010).

Monthly energy consumption of customers is determined by taking readings from the traditional credit or postpaid meters and bills produced for customers to pay within 28 days. Over the years, the Electricity Company of Ghana has struggled with employing effective means to collect the huge amount of money owed it by some of its customers. Technological advancements gave birth to the prepayment metering system and ECG adopted this technology in metering in the middle 1990, specifically in 1995 to address billing anomalies and then to improve revenue mobilization.

1.2 STATEMENT OF THE PROBLEM

There is a general assumption among customers of Electricity Company of Ghana that the prepayment metering system introduced by the company in 1995 to replace the credit or post-paid metering system has benefited the utility company rather than its customers. Based on this assumption, majority of customers of the Electricity Company of Ghana still prefer the post-paid meters to the prepaid meters. This current study seeks to explore the factors affecting the acceptability of the prepaid meters in the study area.

1.3 OBJECTIVES OF THE STUDY

The general objective of this study is to determine the factors customers consider in accepting prepaid metering system.

The specific objectives are to:

1 Determine the level of acceptability of prepaid metering system among customers in Accra West Region.

2 Analyze the factors of customers consider before accepting prepaid meters.

3 Determine management strategies in promoting customer acceptability of pre-paid meters.

1.4 RESEARCH OBJECTIVES

The pertinent questions the researcher wanted answers to are as follows:

1. What is the level of acceptability of prepaid meters among customers?
2. What factors do customers consider in accepting prepaid meters?
3. What strategies have management put in place to promote customers acceptability?

1.5 SIGNIFICANCE OF THE STUDY

This study will serve as a reference material for training of ECG technical staff on issues concerning customer acceptability of the prepaid metering system since prospective prepaid customers will be attended to by well informed field staff.

This study will also serve as a planning material for the installation of prepaid meters in the operational area of ECG because it will help identify communities that have little or no knowledge of the benefits on the use of prepaid meters to be well educated on the advantages that the prepaid meters bring to them.

At the end of it all, this study will facilitate smooth mass installation of prepaid meters across ECG's operational area which will lead to reduction in operational cost and maximization of profit and subsequently increase efficiency of the company.

Again, judicious consumption of energy by customers through the use prepaid meters will lead to surplus energy for ECG and that will be supplied to industrial customers to boost industrialization, economic growth and development of Ghana.

1.6 SCOPE OF THE STUDY

This study is limited to the residential (domestic), non-residential (commercial) customers and some staff of ECG Accra West Region. It is also limited to issues on acceptability of prepaid meters and customers of ECG who use prepaid meters.

1.7 LIMITATION OF THE STUDY

The study had problems with identifying customers who use prepaid meters since not all customers of the Electricity Company of Ghana, Accra West Region use prepaid meters. The researcher had to rely on the Regional office prepaid vending point to administer questionnaire to customers who come to buy prepaid units.

The study also had difficulty in getting literature on the acceptability of prepaid meters in Ghana.

Some of the respondents were unwilling to speak on issues concerning prepaid meters because they had fears that their landlords will not take kindly to the challenges such customers have with the use of prepaid meters since it is the landlords who buy the credit units and charge them for it.

The study also encountered difficulty in getting management report on customer acceptability of the prepaid metering system.

1.8 ORGANISATION OF THE STUDY

This study is divided into five chapters. The first chapter which is the introduction covered areas such as the background of the study, statement of the problem, objective of the study, research objectives, significance of the study, and limitations of the study. Chapter two was devoted for the review of related literature, while chapter three considered the methods used for the study.

The fourth chapter highlighted on the findings and discussions of the study, while the last chapter considered conclusions and recommendations of the study.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 INTRODUCTION

This chapter deals with the following areas: definitions and function of meters, types of electric meters, definitions and types of prepaid meters, the technology and economics of prepaid electricity, the adoption of prepaid meters, people's perception about prepaid meters, how prepayment meters works and the development of prepaid metering systems.

2.2 DEFINITION AND FUNCTION OF METERS

Electric meters measure the amount of electric current supplied to a shop, house or any other source including machines. The electricity board has different terms and conditions for installing various electric meters depending on their usage. These meters help in measuring the amount of electricity being utilized by various sections of society, and therefore, should not be tampered with Electricity cannot be stored in large amounts, and hence, needs generators to produce it. The need of generators would be endless if electricity is not used efficiently.

Electric meters are designed to reduce power consumption during peak hours and also control the power supply to different consumer sections. Electric meters are broadly classified into two categories – electromechanical meters and electronic meters. Further, they can be of various types such as numeric display meters, standard meters, variable rate meters, prepayment meters, electromechanical meters, etc.

2.3 TYPES OF ELECTRIC METERS

Numeric Display Meters – The numeric display meters display the reading in a numeric form. The first five numbers should be read in these meters starting from left to right. **Electromechanical Induction Meter or Standard Meter** – The most commonly used electric meter is electromechanical induction meter or standard meter that operates by counting the revolutions of an aluminum disc. It measures the electricity in kilowatt-hours. In this case, the units are charged at the same rate throughout the day. The electric energy being used is directly proportional to the number of revolutions of the disc. These types of meters are generally used on single phase alternating current (AC) supply.

Variable Rate Electric Meters – The variable rate electric meters give two different types of readings depending on the day and night time. They are also known as 'economy 7' meters, often used by suppliers and industrialists. Usually, their rate is cheaper at night.

Prepayment Electric Meters – The prepayment electric meters accept tokens or prepaid cards to get electricity supply. The customer has to pay the charges for the power supply in advance. One can also top-up the amount for extending the period of electric supply or when the balance over the supply is automatically cut off by a relay in the electric meter. This is common in rented accommodations.

Solid State Electric Meters – The solid state electric meters can be read automatically and their power displayed on an LCD screen. They calculate and show the exact value of the electricity consumed rather than its amount. The rate of the unit consumed varies according to the time and day of the week. They can also record, supply and load

parameters such as power factor, reactive power, maximum demand, etc. Such types of meters use the remote meter reading technology.

Electronic Meters – The latest electronic meters are based on automatic meter reading or remote meter reading technologies. They use GSM, GPRS, Bluetooth, etc. to transfer the information related to power consumption. They store the usage profiles and the load requirements of a consumer and process it accordingly. Electric meters also help in detecting energy theft or any attempts at meter tampering with the help of their inbuilt automatic sensors.

Smart Meters: Smart meters are the latest in energy meter technology: instead of simply providing a total of energy consumption in your home like many conventional meters, smart meters can provide you with detailed information on how and when you used your energy. They also communicate with the electricity company, sending and receiving information so that no one need come out to read your bill and the energy supplier does not need to estimate your bill. There are many ways to get a smart meter reading. These include using a monitor, online monitoring and looking at your bills (UK Power Limited, 2012).

2.4 DEFINITION AND TYPES OF PREPAID METERS

A Prepayment Meter is an easy way to pay for your gas and electricity. It allows you to pay for your energy supply before you use it. If you would like to pay for your gas and electricity in this way, it can be easily fitted into your home, providing it is safe and practicable to do so.

A Prepayment meter will charge for any gas or electricity as you use it. It may also be used to recover any outstanding debt from you at an agreed weekly rate. Some electricity Prepayment Meters may also take a weekly amount to cover fixed unit charges as part of our two-tier pricing structure. When we install a Prepayment Meter, we will provide you with details of our gas or electricity charges. Where there are any additional charges in connection with your Prepayment Meter, we will always tell you what they are beforehand.

According to UK Power Limited (2012), Prepayment meters work in exactly the same way as their name would suggest; instead of paying for your electricity after you have used it, you pay before. UK Power Limited (2012) also noted that, there are two main types of prepayment meters.

The first, standard prepayment meters may either display one or two readings and these should simply be read as above like other meters.

The second type is meters connected to the Pay-point network. This system works by accepting tokens, usually in the form of plastic keys which can be bought and then your supply 'topped up'.

According to Measurement Canada (2006), Prepayment metering is the trade measurement of electricity or gas which is required to be purchased by a consumer in advance of the consumption of electricity or gas. Generally, in a prepayment application, a consumer must prepay for electricity or gas in order to activate their load through the meter. The types of prepayment applications for electricity and gas may vary and can range from a simple advance monetary payment for electricity or gas to the pre-purchase of a fixed quantity of electricity or gas. In principle, under a prepayment application, the

consumer may not receive a subsequent bill as payment is made in advance for electricity or gas. The terms and conditions for prepayment are established by the electricity and gas contractors (also referred to in the industry as suppliers or energy providers), and are subject to regulation. The design, construction, performance, installation and usage of meters intended for prepayment applications are subject to regulation in most countries.

Prepayment Electric meters now come in various types. Among them are:

2.4.1 INTEGRATED SINGLE PHASE (ISP) ELECTRIC METER

The Integrated Single Phase (ISP ED) meter is a compact, two wire, keypad-based prepayment electricity meter in a housing compatible with the ESKOM standard common base electricity dispenser socket(Meter Mate, 2012).

This meter is most suited to new reticulation and is directly and easily interchangeable with common base prepayment meters from other approved manufacturers using the common base configuration. User interaction with the meter and access to meter information (such as a low credit warning, energy consumption, and load contactor status) are available using the keypad and LCD display.

The ISP ED meter is based on the ESKOM Specification, which calls for a prepayment meter that can be fitted into a standard, plug-in common base. This concept ensures simple installation and replacement procedures.

The meter is keypad based, fully STS compliant and supports the 20 digit STS encryption algorithms. The meter has a wide range of information registers which can easily be accessed by pressing the information button on the keypad and then entering the number of the register.

The plug-in-base, which also conforms to ESKOM's specifications, allows the commissioning of the meter to be separated from the installation of the wiring, thereby adding flexibility and installation convenience. Included with the base is a Metal Oxide Varistor (MOV), which ensures that the meter complies with SANS IEC 61643-1 for class 3 arrestors. The base is optional and can be supplied separately to the meter.

2.4.2 THE INTEGRATED THREE PHASE (ISP) METER

The Integrated Three Phase (ISP) meter is a four-wire 100 Amp per phase, keypad-based prepayment meter in a compact BS housing. The meter is suitable for residential, commercial and light industrial environments. The meter also features a dedicated diagnostic indicator which shows the status of communication to the optional remote customer interface unit (CIU).

This valuable visual aid assists the field technician to validate the installation and determine probable fault types. The meter boasts a large custom display and also features a host of standard Meter Mate software features including the ability to operate as a prepayment meter or in credit metering mode.

As a standard feature, the Three Phase meter offers an IEC 62056-21 compliant optical communications port. This allows the utility to access a variety of information stored inside the meter, and to upload it to a hand-held unit.

The meter has two parts, the prepayment meter and the customer interface unit. The meter is connected to the customer interface unit by a two core communications wire up to a distance of 130 metres. It operates independently of the customer interface unit and is usually installed in a secure, locked enclosure outside the consumer's home. The

customer interface unit is compact with a user-friendly keypad and display. An optional local keypad and display can be fitted to the meter at the time of manufacture. The meter also features a dedicated diagnostic indicator which shows the status of communication to the customer interface unit.

The meter contains all critical metering, token decryption and load control functionality. It operates independently and is immune to any form of tampering on the Customer Interface Unit.

The meter is usually installed outside the home in a secure, locked enclosure which should not be accessible to the consumer. This facilitates easy inspection by the utility at any time and reduces the opportunity of fraud by tampering.

The customer interface unit is installed inside the consumer's house in a convenient location. The communications interface can withstand voltage surges of 6kV, however it is recommended that one of the communication lines be earthed at the meter for additional protection.

2.4.3 THE SPLIT SINGLE PHASE (SSP) METER

This is a compact, two wire, keypad-based prepayment electricity meter which comprises two parts, the Energy Management Unit (EMU) and the Customer Interface Unit (CIU). User interaction with the meter and access to meter information (such as a low credit warning, energy consumption, and load contactor status) are available using the keypad and LCD display on the CIU.

The meter consists of two parts namely, the CIU and the EMU. The CIU is the customer's only interface with the meter, and is a compact unit with a user-friendly keypad and display. It is usually installed in a convenient location in the consumer's home - remote from the EMU, and is connected to the EMU with a pair of communications wires.

The EMU contains all critical metering, number decryption and load control functionality. It operates independently and is immune to any form of tampering on the CIU interface. The EMU is usually installed in a secure, locked enclosure, typically a pavement kiosk or pole-mounted equivalent. It is outside the consumer's home to facilitate easy inspection by the utility at any time and to reduce the opportunity of fraud by tampering. As an option, the EMU can be supplied with its own LCD display and keypad, which allows the utility to view important meter parameters without the need for an interrogation tool.

The communications interface can withstand voltage surges of 6kV, however it is recommended that one of the communication lines be earthed at the EMU for additional protection. Should the customer not want to earth a communication line during installation, the meter can be fitted with protection circuitry in the terminal cover.

2.5 THE TECHNOLOGY AND ECONOMICS OF PREPAID ELECTRICITY

Prepayment systems refer to the outlay made by a consumer for using a good or service before consumption. In the case of electricity, the distinctive feature of the prepayment system is the reversion of the conventional commercialization system: whereas in the latter consumers hold a consumption credit because they pay for their energy bills

periodically and after consumption, in the prepayment system such credit is not available because the purchase and payment of energy are made prior to consumption. Thus, prepaid systems allow users to consume energy only when they have credit in electricity account, as supply is discontinued when such credit is exhausted (Kwan et al, 2002). A Prepaid Energy Meter enables power utilities to collect electricity bills from the consumers prior to its consumption. The prepaid meter is not only limited to Automated Meter Reading [AMR] but is also attributed with prepaid recharging ability and information exchange with the utilities pertaining to customer's consumption details (Southgate et al, 1996).

The prepayment technology was initially developed in South Africa in the late 1980s with the objective of supplying energy to a large number of low-income and geographically dispersed users. The system was initially geared to minimizing the difficulties arising from users' irregular incomes and to overcoming the limited development of the infrastructure required for the dispatch and reception of credit slips. By the late 1990s, prepayment systems were very popular in India and in some OECD countries (Estache et al., 2000), and had probably reached their highest development in Great Britain (Waddams et al., 1997). In Argentina, prepayment meters were firstly introduced in 1993, when Energía Mendoza Sociedad del Estado (EMSE) put a few running in small shops at the Mendoza Bus Central Station. The experience was soon extended to other communities in the country.

From a technological point of view, the prepayment system consists of three well differentiated components. The first is a service meter installed at the unit where energy will be consumed, such as a household dwelling or a store. In general, these meters are of

the “two-gang” type and consist of a user’s interface unit and a current measuring set. The interface unit is a device installed inside the building, which allows the user to “interact” with the meter. The metering unit, on the other hand, is the intelligent component that stores credit and consumption information and it makes up the element that either clears or switches off electricity supply. The second component of the system is the so-called credit dispensing unit, which is the vending machine where consumers can purchase electricity credit. In general, these sales outlets are located at the utility’s commercial offices as well as in stores with long opening hours. The third component is the supporting device that links the various sales outlets to the utility’s management system.

The way the system works for the user is simple. The user purchases energy at the sales outlet and, as part of the operation, receives a credit slip and a supporting device that identifies the operation, which may be a voucher with an identification code or another with a magnetic support. The user then utilizes the device to add on her new consumption credit, either by entering a code or inserting the magnetic medium into the interface unit, which in both cases will be possible only if the device identification matches that of the meter.

The measuring unit then clears consumption of the amount of energy purchased and also displays, in real time, the available credit remaining for consumption. The meter switches off when credit is exhausted, and it switches on again only when the device corresponding to a new purchase is inserted.

From an economic perspective, the reversion of the commercialization system as implied by prepaid meters translates into changes in the cash flow of the utility and in consumers´

behavior. In the case of the firm, prepayment systems may result in a decrease in metering, billing and disconnection and reconnection costs. The fact that payment is made prior to consumption implies both a significant improvement in the collection of revenues and a reduction of working capital. Moreover, prepaid systems may constitute a way to provide more flexible payment options to users with minimal or unreliable income streams without increasing transactional costs to the firm. From the consumer's perspective, prepayment systems may result in a better understanding of how much energy is being consumed, inducing more control of energy use and budget management (Tewari and Shah, 2003). However, these apparent improvements are not cost free: not only the change from conventional to prepaid electricity imply a change in consumption habits, which may reduce the utility of consumers, but also it may result in too few electricity consumption or in the self-disconnection of poorer groups of consumers.

2.6 THE ADOPTION OF PREPAID METERS

Electricity is a vital element required for economic growth, poverty reduction and social development. For a stable and economically viable electricity distribution system and an effective and trust worthy revenue collection system a country wide pre-paid metering system is evident. An adaptation of pre-paid metering system can change the needs and the requirements of better solution for the utility companies that make the whole distribution system more dynamic and digitally enhanced. The Power Division has taken the initiative through all distribution utilities to implement a pre-payment metering system with a view to reduce non-technical losses, increase the revenue collection, improve customer's service and reduce the accounts receivable. Governments across the globe have there for given priority to prepayment metering system, considering all the benefits (Power Division, 2011).

The concept of prepayment is not new. It was invented in United Kingdom before the Second World War, but major changes had taken place in the 1980's when electronic transfer of credit was introduced (Enbaya 2003).

The prepayment system in electricity was however adopted for the first time in Argentina in 1996, when CELCA4, the power distribution company of Carmen de Areco, a small municipality of the Buenos Aires Province, made optional to all consumers within its franchise area the use of prepaid meters. CELCA was created in 1945 and is one of the almost 200 municipal electricity distribution utilities operating in the Province of Buenos Aires. These utilities, most of which were organized as cooperatives, were traditionally allowed to set their own tariffs until 1996, when privatization of the then vertically integrated electricity operator of the provincial state called ESEBA resulted in the creation of independent power producers, three new regional electricity distribution utilities , in whose exclusive franchise areas municipal utilities operate and a new provincial regulatory authority, named as Organismo de Control de Energía Eléctrica de la Provincia de Buenos Aires (OCEBA).

Following privatization, local electricity distributors purchase energy from one of the three regional utilities at OCEBA's regulated tariffs. This agency also regulated the final tariffs local distributors charge to final consumers.

2.7 PEOPLE'S PERCEPTION ABOUT PREPAID METERS

Several Countries including Ghana have changed from its normal post-paid electricity system to a new and advanced one, the prepaid electricity meter, which is popularly known as 'prepaid' (**Rexrichie, 2011).** The question we should ask our self now is "are we ready to rank our energy resources specifically electricity, this high?" According to

Mr. Fred Enninson of the ECG, in charge of the pre-paid meter faults, the introduction of the prepaid meter, though having problems in the initial stages, people will soon get abreast with how it operates. The ECG's main concentration is the easiness that the prepaid meters has brought to their workers and not to the normal Ghanaian. Moreover he said "customers of ECG are now free from monthly billing" He used the phrases free very nicely to my understanding but this might not be well understood by a well-resourced economist who knows the difference between his opportunity cost for prepaid meters and a mere 'free' word as he used it.

Prepayment has gained increased attention in the last several years. The primary reason is that customers switching from credit billing to prepayment almost always reduce their electricity consumption.

- Salt River Project reports a 12.8 percent reduction in energy use when customers switch from credit to prepay.
- Northern Ireland Electricity says that prepay customers use 4.9 percent less electricity than th average customer.
- Oklahoma Electric Cooperative reports that customers lowered consumption 13 percent after switching to prepayment.

Granted, customers electing prepayment are likely to be those most motivated to reduce utility bills. However, in the vast majority of cases, these customers were equally motivated under a credit billing system. What was missing was the immediate feedback of knowing 1) exactly how much power or gas they were using in near real time, and 2) how closely their consumption matched their planned budget.

Despite all the advantages to both customers and utilities, and despite many requests for prepayment programs from some consumers and their advocates, prepayment is not a widespread global phenomenon. Three major issues have slowed adoption (Oracle, 2009):

High Cost: Today's utility typically views prepayment as a second, parallel metering and billing system largely separate from the system used for credit customers. For instance, in U.S. cost estimates of $225 to $450 per prepayment participant are common, far more than the anticipated investment return to the utility from early payments plus reduction in bad debt.

The equation is different, of course, in jurisdictions that use prepayment for most or all customers. In South Africa, for instance, Eskom has typically implemented prepayment using rechargeable cards and top-up kiosks as it has expanded its grid to each new town and village. Such an approach may also be practical in regions now moving to metering after a long period in which gas and electricity were viewed as essential public services and therefore unmetered.

Utilities with long histories of credit billing, however, have frequently balked at the prospect of spreading the costs of implementing a new and expensive metering and billing system across all customers when only a few will benefit. Some regulators have expressed similar concerns.

Fairness: In some jurisdictions, regulators and consumer advocates have expressed concerns that utilities might force prepayment onto customers in low-income areas, thus stigmatizing customers whose positive history of bill payment may equal or frequently exceed those of their wealthier neighbors. This concern has faded as prepayment has

become the payment method of choice for mobile phone and similar services (Oracle, 2009).

A different fairness issue has arisen recently in the U.K. There are reports that retailers in this fully competitive market will agree to serve prepayment customers only at excessively high rates.

Health and Safety: Health and safety concerns may restrict prepayment (Oracle, 2009):

- When electrical service terminates in a prepayment system, appliances may still be "on." If the person reinstating service fails to check appliances like stoves, a fire could result.
- Buildings with pilot lights need to maintain some gas flow even when prepayment deposits run out, lest reinstatement of service cause an explosion.
- For different reasons, water prepayment systems may choose to permit a minimal flow at all times, lest lack of water lead to a neighborhood public health crisis.
- Most jurisdictions have rules against utility disconnection of gas and electricity during the heating and air conditioning seasons. Customers could easily fall behind in payments during these periods, and catch-up payments may be difficult to administer in parallel with overall prepayment methodology.

According to Oracle (2009), these arguments have slowed the growth of prepaid metering. Today, however, the need for conservation plus new, less costly prepayment technologies are sparking a surge of interest.

2.8 EFFECTS OF PREPAY METER SYSTEM

A big chunk of electricity that power companies generate is lost or remains unaccounted for. This is partly due to the technical losses at the power plants and in the transmission and distribution lines. There is another high percentage loss due to non-technical reasons at customer level such as tampering with the meter, illegal connection and so on. Various attempts have been made to address these vexing problems of non-technical losses such as contracting out meter reading and billing, computerized billing and cut-offs and legal penalties. But nothing has been 100% successful so far. However, amongst all the efforts and endeavors, the one approach that proved to be consumer friendly and cost effective was the prepaid metering system (Power Division, 2011). Pre-payment metering system can reduce accounts receivable and non-technical losses up to zero per cent. The idea of using prepaid meters therefore is to stem the financial drain on power companies such as ECG (Power Division, 2011).

According to Ariel A. C. and Luciana N. (2008), consumers switching from the conventional to the prepayment system face two types of cost. One refers to the direct monetary cost, while the other refers to differences in habits that result from replacing a post-consumption and single monthly payment with more frequent payments, which occur prior to consumption. The main direct monetary effect is the cost of the new meter and its associated opportunity cost, which we proxy using the interest rate for savings accounts deposits, which was estimated relating consumers' average expenditure to a rate capturing the opportunity cost of money.

According to Eskom (2010), the prepaid meter (PPM) system has several important components. First, there is the prepaid meter (or 'electricity dispenser' - ED) which is installed in the household. The ED is activated by the input of a 'token', which indicates how much energy the customer has purchased. The token comes in a variety of physical forms, but essentially it represents a string of numbers that are entered into the ED to authenticate the transaction. In the early stages of the industry, the tokens were disposable cards with magnetic strips, but in the late 1990s keypads became more popular as input mechanisms. The token used for keypad activation is just a string of numbers, communicated to the consumer orally, in written form, or even via an SMS or e-mail.

Periodical purchases of electricity imply a change in consumer habits, because they have to incur the extra costs associated to the time spent on additional buys. The extent of this cost would vary with the periodicity of energy reloads (it would be neutral if reloads occurred once a month, as this would demand an effort similar to that incurred when paying the conventional monthly bill) and it would be directly dependent on the user's salary; it is possible to presume that the higher an individual's salary, the higher the opportunity cost of her time. We therefore estimate this cost by firstly computing an average hourly cost that we approximate using census income data for the district, and then multiplying that cost by both the estimated duration of each reload and the average number of yearly purchases made by each household using the prepayment system.

Thus, in principle, prepaid metering offers utility providers the possibility of decreasing the administrative and financing costs of electricity delivery, which in turn will bring down the cost of electricity delivery, or yield higher returns to the utility, or both. Utility providers have long been aware of the potential advantages of prepaid electricity delivery

over credit metering, but it was not until the mid-1990s that (partly as a result of the technology development led by Eskom) the prepaid meter (PPM) technology evolved to a level that would allow its widespread implementation (Ariel A. C. and Luciana N., 2008).

The Power Division of the Ministry of Power, Energy and Mineral Resources, Republic of Bangladesh, has summarized the benefits of prepaid meter as follows;

Customers like the system because (Power Division, 2011):

- It is transparent
- Easy to add credit to the meter through smart card
- They can control their own consumption
- They can control their budget
- No hassles with bill payment, disconnection or reconnection
- There is no minimum charge
- Require no deposit
- No more disputed bills
- Warning for low credit
- Abnormal voltage protection
- Automated record keeping

The power company also benefits in the following way (Power Division, 2011):

- Upfront payment,
- Improved cash flow,
- Decreased non-technical losses,
- Lower overheads expenses (no meter reading or billing),
- Increased revenue,
- No outstanding debt
- Tamper protection

- Non-allowance of over sanctioned load
- Better load management.
- Better customer services
- Automated record keeping
- Create power saving attitude to the consumers

Using software to run prepayment rather than hardware has a number of advantages (Oracle, 2011):

- Elimination of hardware costs—not just procurement but also installation, maintenance, and replacement.
- Extension of the program to all interested parties. There are no special meters. Any advanced meter will do, so long as it includes either remote connect / disconnect or flow restriction capabilities.
- The utility can use a single billing system for all customers, provided it has appropriate capabilities.
- Customers can use a utility's existing infrastructure for payments. Granted, some utilities may choose to offer tokens or smart cards, plus the ability to top them up. Others may choose to offer in-house displays but neither is required.

2.9 HOW DO PREPAYMENT METERS WORK?

In general, it is considered that the electricity prepayment meter measures energy in the same manner as a conventional meter. The main difference with a prepayment meter lies in the intended manner in which the meter is to be operated and used for the sale of electricity.

In the case of a conventional electricity meter, once a customer's load is energized, energy consumption is measured integrally on a continuous basis and a measurement reading is taken or established by the contractor on a periodic basis for the purpose of establishing a charge for electricity. Payment for electricity is made by the purchaser following the declaration or estimation of consumption of electricity for a certain period of time.

In the case of a prepayment electricity meter, the meter also measures electricity consumption integrally but the measurement is actually started and stopped in conjunction with the activation and deactivation of the load circuit by the prepayment control system. To activate the load circuit, the consumer must prepay for electricity usage or purchase a quantity of electricity (note: a contractor's fixed charges may be included in this purchase). The payment information may be loaded on the meter through a specific peripheral control device (e.g., magnetic card reader or telemetering system). Once activated, the load circuit will run and remain activated until the monetary or equivalent energy information loaded into the prepayment control system has run out, subject to any other conditions established by the contractor.

To charge the meter, consumer needs to buy electricity in advance according to his/her requirement. The consumer can buy electricity through various vending options. The vend results in a token with a code printed on it. The consumer punches the code into the meter either directly or through an in-home display using a key pad. The meter is credited with the amount of credit bought and supply is switched on automatically at load side

As the consumer’s balance reaches the emergency limit provided by the utility, meter sends an alarm. The consumer needs to recharge the meter at this point. If recharged in

time then the load is not disconnected. However, if even after warning, a consumer does not recharge their meter and all available balance is exhausted (as per the prevailing tariff defined in the meter) and there are no “Friendly Credit Days / Friendly Credit Hours” then meter automatically disconnects the supply at load side.

The system provides real time consumption information in terms of money and connected load which attracts the consumer’s attention and leads to their involvement with the system. This also helps consumer in identifying their connected load at any given point of time and their consumption in terms of rupees. The system provides many features; few of them are listed below:

- Any time anywhere recharge facility: This becomes possible as the system works on keypad based technology, hence the token can be got by vend through phone, SMS or web at any time and at any place.
- Friendly days / hours: For the ease of the consumer as well as of the utility, the system is designed in such a manner that it will not disconnect the supply or will not give any alarms on predefined day or hours. These days or hours are called friendly days or hours.
- Emergency credit limit: To make the consumer aware that their credit will be exhausted within a specified time interval, the system has a provision of emergency credit limit. This is an optional feature, which depends upon the utility, they may choose to configure it or not.
- Alarms visual / buzzer: To attract the consumer’s attention the meter gives an alarm to consumer regarding the actions it will be taking. This is a buzzing alarm as well as a visual display on meter/CIU. This enables consumer to take necessary action.

- Supports a variety of tariffs: The Indian tariff structure is complex and there are a variety of tariffs like slab rate, TOD / TOU, fixed charge, monthly minimum charge, etc. All tariffs are supported by the system.
- The meter has Load control mechanism to implement Load Management Program. They have provision to define the allowable loads for given time periods within a day, provision in the meter to accommodate the date of activation of the defined load allocation and Load limit. All tariff calculations are done within the meter not in the vending stations. The meter is required to support stepped tariffs structures as well as time-of-use and maximum demand. The meters have remote communication option which is able to interface data communication with the central server from meters. So it is possible to control the meter from remote if necessary.
- The system provides standardized data exchange mechanism. The data exchange media is the smartcard or key code tokens. This carries both tariff and recharges amount data from utility to meter and carry usage data from meter to utility. A standardized data format for the smartcard has been proposed. Since many manufactures use different encoding and security within their meter. The meter manufacturer must provide Encrypted Data Generation SDKSDK/API to create this encoded data from raw data to the utility, generate encrypted that is suitable for the meter to process and understand.
- Software of the Pre-Paid Metering System has mainly two parts, the **Master Information Center (MIC**) and the **Data Network Service Provider** (Mobile Network Companies). **T**here is one Master Information Center (MIC) per utility company. The Master Information Center (MIC) comprises of the Database Servers(RDBMS), Routers and the Firewalls, Application Server, Short Message Server (PUSH-PULL SMS), Accounting and Billing Server. The consumer of the

electric utility will enjoy credit recharging facilities using Point of Sales (POS) services, where the utility consumers have to recharge their credits. Utility Vending Stations performs the same function as POS but this will be managed by the utility itself round the clock.

- **Contactor**: A local contactor is the connecting link between the consumer load and utility supply. The opening and closing of this contactor depends on the balance present in the prepaid card at a moment. While the prepaid card has some fixed amount more than zero, it stays closed and keeps the utility supply uninterrupted to the consumer load. When the card runs out of balance, it opens and disconnects the load from the supply. Hence, even when the energy meter receives voltage supply, it does not reach the load while the contactor is open because the balance in the prepaid card is not available. Since the contactor too will consume some amount of electrical energy, it will be inclusive in the calculations made by meter and prepaid card.

2.10 DEVELOPMENT OF PREPAID METERING SYSTEMS

Despite being associated in most people's minds with the late 1980s and 1990s, prepaid technology in South Africa dates back to 1913, when the mining settlement of Jaggersfontein (situated in what is now the Free State) minted 10 000 special tokens, each of which released three gallons of water from the town pump (Balson 1997).

However, notwithstanding examples such as the Jaggersfontein 'water penny', the majority of electricity supplied to domestic consumers up to the 1980s was supplied using 'credit meters', in other words, meters which record consumption, with their records being collected by meter readers and bills then being issued based on metered (or in some cases, estimated) consumption. The process of reading such meters, distributing bills,

dealing with arrears and so forth proved costly in economic, and maybe even more importantly, political terms, however. Since credit meters simply record consumption, the process of disconnecting a household from electricity supply involves an obvious intervention on the part of the electricity utility, and since all domestic electricity utilities in South Africa have been state-owned, the process of electricity disconnection is an easy one to politicize.

As was noted above, electrification of black areas such as Soweto was accompanied by politicized payment boycotts, and in this context engineers working in the field of electricity supply were given an incentive to design revenue collection systems which could alleviate the need to physically manage electricity connections (and disconnections). In 1985, Don Taylor, an engineer who at the time was working for the South African Astronomical Observatory in Cape Town, was approached by the QwaQwa Development Corporation to solve the revenue collection problems they were experiencing in the electrification of the QwaQwa 'homeland' (in the eastern Free State). The development of low-cost integrated circuits from the 1970s onwards, and the resulting ability of implemented complex encryption algorithms in a compact device, allowed for the development of a fully electronic prepaid meter system, based on the sale of numeric tokens (in early devices supplied on paper cards, and in later devices printed on a payment slip) from a central point. These tokens then had to be entered into the prepaid meter for electricity to be supplied.

In their earliest form, prepayment meters consisted of coin operated mechanical meters. From the late 1980's forward, electronic meter technology combined with card encoding and various telemetering communication techniques have been used in prepayment meter design (Measurement Canada, 2006). In recent years, there has been a growing interest

amongst government departments and industry stakeholders to identify new methods for managing and conserving energy to meet rising demand at the residential and commercial/industrial trade levels. In the electricity industry, the use of prepayment applications combined with time-of-use is being closely reviewed as a viable means for reducing overall demand in the electricity marketplace.

Eskom was drawn into the development process of the prepaid meter by Taylor and his colleagues at an early stage, being consulted in 1986 during product development to comment on technical issues. This involvement alerted Eskom employees to the possibilities of electronic prepayment technology, and they later expressed an interest in using prepaid technology for their 'Electricity for All' campaign. Although 'Electricity for All' was only launched in 1988, McRae speaks of the ideas for the project emerging from 1985 onwards; thus the discussions in 1986 fed into the early planning for the campaign, which, at the time, aimed to connect 5 million households to the electricity grid, on a purely business – i.e. cost recovery – basis (McRae 1998).

With a product in hand, Taylor's colleague Rudi Coetzee went on a marketing campaign, which led to small installations at Thabong Municipality (in the Free State), Witrivier Municipality (now in Mpumalanga, this installation was facilitated by the 'coloured' House of Representatives, one of three racially defined houses in the apartheid Parliament) and elsewhere during 1987. Another early prepaid entrepreneur, Larry Barnett, gave a presentation in Parliament on prepayment technology, with the result that elements in the apartheid government moved to standardize the technology as a means towards quality control. Taylor mentions that there were fears that poor-quality prepaid technology products could exacerbate anti-government feeling in the townships. The

South African Bureau of Standards, the Council for Scientific and Industrial Research and Eskom were all drawn into this standardization programme, which would take several years.

Eskom's involvement in the prepaid field shifted to an entirely new level, however, in 1989, when the decision was made to use prepayment technology for its national electrification programme. Taylor and Coetzee's venture, Angcon Technologies, received a contract to provide 6 000 prepayment meters for installation in Kwamobuhle (near Uitenhage, now in the Eastern Cape). This was, however, only a small part of Eskom's overall 'Electricity for All' programme, which grew to a maximum of more than 250 0000 installations in 1993 (Gaunt 2003:28).

At the same time that Angcon Technologies and others were providing prepaid meter systems to Eskom, multinational telecommunications firm Plessey-Tellumat started a programme of aggressively marketing prepayment technology to municipalities. By this time apartheid was crumbling, and white business was clearly focused on a post-apartheid future. In line with this planning, Nedbank and Old Mutual collaborated on a study in 1990 entitled 'South Africa: Prospects for a Successful Transition' (Gaunt 2003) which, amongst other things, promoted mass electrification as a mechanism for social and economic development. Engineers within local government also got involved in the debate, with Gaunt presenting s paper to the AMEU in 1991 promoting national electrification and tariff rationalization (Gaunt 2003). The result of this policy work (which was also significantly supported by the University of Cape Town's Energy for Development Resource Centre) was an increasing number of new electricity users connected via municipal utilities, growing from 51 000 new connections in 1991 to 164

000 new connections in 1993. Already in 1989 Gaunt had proposed – in the journal of the South African Institute of Electrical Engineers – that 'conventional systems' would not allow for large-scale electrification of domestic consumers, and so when electricity was rolled out, so were prepayment systems (Gaunt 2003).

There is some disagreement in Cape Town as to when prepayment technology was actually adopted in the city. Neil Ballantyne, Manager for Revenue Protection for the Electricity Directorate of the City of Cape Town (CCT – the new name of the local authority that was formerly called the Cape Town City Council) in 2006, speaks of an initial rollout in Hanover Park (a historically coloured area of Cape Town characterized by council rental housing and the poverty y of its inhabitants) in 1993 (Ballantyne interview). Yet Hans Smith, who was in charge of housing projects in Cape Town in the 1980s, recalls using the technology in earlier projects (Smith, 1980). Details aside, it is clear that by the early 1990s both the notion of 'Electricity for All' and the use of prepayment technology in the delivery of that electricity were established concepts in the city.

The concepts were further developed in a conference on the electrification of developing communities which was held by the South African Institute of Electrical Engineers in 1991, in the ANC's national Meeting on Electrification held in February 1992, and in the work of the National Electrification Forum (NELF), which met between 1992 and 1994. From 1990 onwards, Eskom developed the NRS009 standard, which allowed for standardization of prepayment technology and therefore the ability to make units sourced from different vendors interoperate. This was initiated from 1993 onwards (Eskom 2007), eventually leading to the creation of the Standard Transfer Specification (STS) to

which all South African prepaid meters comply. (The STS was later developed into an international specification by the International Electro-technical Commission with the result that STS-compliant prepaid meters are now in use throughout the world).

The narrative above demonstrates that, from its beginnings in a single small engineering project, prepayment technology rapidly became a tool adopted on a national scale by policy-makers and professionals in the electricity sector. The engineers involved in this development were, however, acutely aware that the technology they were developing had to be adopted by electricity users, in particular the newly electrified townships users – black and poor – if it was going to be successful. As Taylor remarks, 'prepayment had [a] connotation with being "not credit worthy" (you had to pay first) and was also seen as being used by government as a way to counter the service payment boycotts.

As a result, prepayment technology was marketed not just to Eskom, municipalities and government decision-makers, but also to its intended recipients. Taylor mentions that the early prepaid meters were called Budget Energy Controllers (BECs), and were promoted as a way to 'put the consumer in control' (of their electricity expenditure). Cosmetic approaches were also taken – BECs would not be black because 'black clothing and drove black cars)'. Neil Ballantyne notes that during the Cape Town City Council's prepayment pilot project in Hanover Park in 1993, township unrest was affecting the electricity department: 'that's why when we started with installation of the meters we actually branded our vehicles to support those meters completely differently. In other words, it was almost like the good guys and bad guys situation. The trucks for the disconnections, people knew what they looked like, and they were the bad guys, we were the good guys going in with cars with "energy dispenser support" written on the side, and

the guys didn't really have trouble because they were seen as the guys helping them' (Ballantyne, 1993). In Lavender Hill, another coloured township in Cape Town Councilor Eulalie Stott held meetings with local residents, using electrical appliances to explain the details of electricity consumption (Smith, 2004). Don Taylor states that 'we set up training and demonstrations in the community gathering halls with educational programmes promoting the concept of prepayment and training consumers on how to use the meters; this was of cardinal or prime importance as the slightest sign of customer difficulty would jeopardize the entire installation.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter deals with the statistical methods used for the study and includes study area, population and sampling techniques, data collection procedure, research instruments, research design and data analysis.

3.2 STUDY AREA

Stratified sampling method was be used for this study. The customers in Accra West Region were stratified according to the types of consumers (that is domestic and commercial). Samples were drawn from each strategically proportionately until the intended sample size was reached.

3.3 POPULATION AND SAMPLING TECHNIQUES

The Accra West Region is made up of six districts namely Korle-Bu, Achimota, Nsawam, Bortianor, Dansoman and Kaneshie. Simple random sampling method will be used to select one of the districts for the study. It is estimated that, Electricity Company of Ghana (ECG) has about eighteen thousand (18,000) customers in each district.

The Yamane's simplified formula was used to calculate the sample size for the study. It is defined as $n = \frac{N}{1 + N(e)^2}$

where

n: *sample size*

N: *Total population for a District*

e: *The Precision*

$$n = \frac{18000}{1+18000(0.05)^2}$$

$$n = 391$$

Therefore the sample size chosen from a district for the study was 391 ECG residential and non-residential customers. The industrial establishments were left out because their installed load capacities are too large for the installation of prepaid meters and hence do not use prepaid meters.

3.4 DATA COLLECTION PROCEDURE

The main instrument for data collection was the questionnaires. This was comprised of both open ended and close ended questions. The blend of these methods offered an in depth study on customer acceptability of prepaid meters.

3.5 RESEARCH INSTRUMENTS

Both the primary and secondary sources of data were used. The primary source of data was gathered through the use of questionnaires and it had highlighted issues such as customer level of acceptability of prepaid metering system, factors affecting the acceptability of prepaid meters and strategies of promoting customer acceptability. In the case of the secondary source of data, management reports on customer acceptability were used.

3.5 RESEARCH DESIGN

The research design used for this study is cross-selection descriptive which employed several methods.

3.6 DATA ANALYSIS

The data gathered were presented using tables and charts. The purpose of the presentation is to summarize the data as well as give a pictorial analysis. The data presented was analyzed using percentages.

3.7 PRE-TESTING OF INSTRUMENTS

The questionnaire was pre-tested before the field study. Twenty questionnaires were sent to Accra East Region to be administered on the customers. Accra East Region was chosen because it is similar in character to that of Accra West Region. The essence of the pre-testing was to ensure the reliability of the instrument.

CHAPTER FOUR

ANALYSIS, DISCUSSION AND REPRESENTATION OF RESULTS

4.1 INTRODUCTION

This chapter presents analysis on the data collection for the study. It relates to determining customer perception and acceptability on the use of prepaid metering systems, factors customers consider before accepting prepaid meters and ECG managements' strategies in promoting the use of prepaid meters. The socio-demographic characteristics of respondents are first analyzed to help understand customers' perception and attitudes in accepting prepaid meters.

4.2 SOCIO-DEMOGRAPHIC CHARACTERISTICS

The following socio-demographic characteristics were considered. Age, sex, level of education, years of using prepaid meters, tariff class.

4.2.1 SEX OF RESPONDENTS

The study found that out of the 391 respondents used for the study, 77.8% are males whilst 22.2% are females. This implies that more male customers are using the prepaid meters than females. The details are presented in table 4.1.

Table 4.1 Sex of Respondents

Sex	**Frequency**	**Percentage**
Male	304	77.8
Female	87	22.2
Total	**391**	**100**

4.2.2 AGE OF RESPONDENTS

The analysis on the age of respondents indicated that majority of the customers (47.3%) are between the ages of 30-39 years. This is followed by customers in the age group of 40-49 years and they constitute 30.7%. Customers between the age group of 50-59 years were found to have the least representation of 5.6%. The details are presented in table 4.2 below.

Table 4.2 Ages of Respondents

Ages of Respondents	Frequency	Percentage
20-29	64	16.4
30-39	185	47.3
40-49	120	30.7
50-59	22	5.6
Total	**391**	**100**

4.2.3 LEVEL OF EDUCATION OF RESPONDENTS

The study found that the level of education of respondents was generally high in the study area. It was found that as high as 33.8% of the respondents has tertiary level education and this is followed by 28.4% of those who have secondary level of education with only 12.3% having no formal education. 25.5% if the respondents however had primary education. The details are found in table 4.3.

Table 4.3 Level of Education of Respondents

Level of Education	Frequency	Percentage
Primary/JHS	100	25.5
Secondary/SHS	111	28.4
Tertiary	132	33.8
No Education	48	12.3
Total	**391**	**100**

4.2.4 YEARS OF USING PREPAIDMETERS

The years of using prepaid meters was bought and the responses are that 49.6% have used prepaid meters between 1-4 years, 25.5% have also used prepaid meters for less than a year. A smaller percentage (10.7%) has used prepaid meters for over ten (10) years. The details are presented in table in table 4.4.

Table 4.4 Duration of Usage of Prepaid Meters by Respondents

Duration	Frequency	Percentage
Less than one year	88	22.5
1-4years	194	49.6
5-9years	67	17.2
10years	42	10.7
Total	**391**	**100**

4.2.5 TARIFF CLASS OF RESPONDENTS

The study found that 54% of the respondents are in the residential tariff category and the non-residential or commercial tariff category of respondents make up 46%. The details are presented in table 4.5.

Table 4.5 Tariff class of Respondents

Tariff Class of Respondents	Frequency	Percentage
Residential(Domestic)	211	54
Non-residential(Commercial)	180	46
Total	**391**	**100**

4.3 CUSTOMERS' PERCEPTION ON ACCEPTABILITY OF PREPAID METERS

The perception customers hold on any new product being introduced directly or indirectly will affect whether such product will be patronized by customers or not. Based on the background, customers of ECG Accra West Region's perception were explored and the findings are presented in table 4.6.

Table 4.6 Customers' Perception on Acceptability of Prepaid Meters

Customers' Perception on Acceptability	Frequency	Percentage
Very acceptable	48	12.3
Acceptable	52	13.3
Fairly acceptable	183	46.8
Not acceptable	48	12.3
Indifferent	60	15.3
Total	**391**	**100**

From table 4.6 above, it was found that a very small percentage of customers (12.3%) indicated that the introduction of prepaid meters is very acceptable. The reasons for this are that they can now regulate their energy consumption and only buy what they need at a time. Again, the customers felt it was very acceptable because no bills will be brought to them any longer and field officers will no longer embarrass them with disconnection of power supply for their inability to pay their bills on time.

The study further found that with the introduction of the prepaid meters, the services of meter readers will not be needed. As such, fraudsters who pose as ECG meter readers can no longer intrude their premises. 13.3% of the respondents indicated that the introduction of prepaid meters is acceptable. This category of respondents is very small. They are of the view that even though prepaid meters help them by not accumulating any debt owed to ECG, they have few reservations about its use, and that makes it not very acceptable. The respondents are of the view that most of the time the prepaid meters trip off and they have to locate ECG technicians to come and restart the meters for them, causing a lot of inconvenience to them including the power outage during this period. They also indicated that there are few prepaid meters vending points and most of the times have to travel longer distances in search of units to buy and this situation causes a lot of inconveniences to them.

The study further found that most customers cannot read the energy consumed by their meter and as such cannot determine when they will run out of units and due to this, most often they run out units at the time they need the power the most causing embarrassment to them. As high as 46.8% of the respondents, did not see anything good with the

introduction of the prepaid metering system and were of the view that the postpaid meters should be re-introduced to replace the prepaid meters.

Their reasons are that, most of the prepaid meters are of inferior quality and break down very often as compared to the old postpaid meters which can last for about ten (10) years without repair. It was further found that in most cases, the purchase card becomes defaced and at times faulty. Due to this, the card will need replacement before units can be loaded on the card and during this period, customers will have to stay in darkness until a purchase card is replaced. This situation hitherto was not a problem when the postpaid meters were being used. Another reason why the respondents felt that the use of the prepaid meter was not acceptable is that they have the perception that the prepaid meter runs faster than the postpaid meters they were using and this make them pay more for little power used. In addition to this, the fact that with the use of the prepaid meters, one needs to buy the units before consuming and cannot credit any units, make it difficult for customers who will at a point do not have enough money to purchase credit for use. This was not in the case of the postpaid meters where one could credit units until he has enough to pay before making purchases to consumers. This means that with the use of the postpaid meters, customers were given the chance to pay for the units consumed at their convenient time for and especially at a time they have enough to pay.

From these standing points, such customers are confused and they think both the prepaid and postpaid meter are good and any of them can be installed for them. Some customers perceive the introduction of the prepaid meter as fairly acceptable and they constituted 12.3%. They are of the view that when ECG is able to purchase durable prepaid meters and train enough field officers to respond promptly to customers' demand in relation to the use of the prepaid meters, the services will be acceptable. It was also found that when

accesses to vending points are improved and the units can be bought anytime of the day even in the night, can convince customers to accept the use of prepaid meters.

From the above, it can be concluded that majority of the respondents think that the use of prepaid meters are not acceptable because of the numerous problems associated with it. They also think that the old postpaid meters do not give customers a lot of problems as compared to the prepaid meters and as such the old postpaid meters is preferred to the prepaid meters.

4.4 FACTORS CUSTOMERS CONSIDER BEFORE ACCEPTING PREPAIDMETERS

Customers are known to be rational as such take into consideration a number of factors before making a decision on whether to accept and use a facility or a product or not. When customers identify that there are more merit to be gained, all things being equal, they accept and use the product or facility. Based on this background, the researchers wanted to determine the factors that influence customers' acceptability and use of prepaid meters. The details are summarized in table 4.6

Table 4.6 **Factors Customers Consider Before Accepting Prepaid Meters**

Respondents	**Frequency**	**Percentage**
Reliability of prepaid meters	149	37.6
User friendliness of prepaid meters	83	21.2
Durability of prepaid meters	64	16.4
Accessing to prepaid vending points	40	10.2
Cost of installation of prepaid meters	34	8.7
Availability of technicians to repair faults of prepaid meters	23	5.9
Total	**391**	**100**

From table 4.6, it was identified that the main factors customers consider before accepting a prepaid meter is the reliability of the meter. This constituted 37.6% of the respondents. Most customers have the perception that the old postpaid meters are very durable and can be fixed for over 25 years without developing any fault. In contrast meters installed are not durable. It was found that a major lightning strike or a power surge normally causes the prepaid meters to be faulty. Based on this and the fact that ECG at one time replaced a brand of prepaid meters with another on the basis of durability has made most customers very skeptical about the acceptance of the prepaid meters.

The study also found that most often the meters trips off or the prepaid meter purchased card becomes faulty and makes it difficult for customers to upload units bought onto the meter and thereby causing a lot of inconveniences to customers. This situation makes some customers makes some customers unwilling to accept prepaid meters for fear of its durability.

Another factor customers consider is the user friendliness of the prepaid meter. This constituted 21.2% of the responses. Some prepaid meters are thought to be not user friendly especially the Smart Cash brand of prepaid meters which uses infrared rays from a remote control unit to communicate with the meter. This calls for a user who can read and write and can be able to communicate with the prepaid m meter when uploading or looking for the units consumed or units left.

Since it is not very use friendly, majority of customers need to engage other people to help them upload credit to the meter and it normally causes a lot of inconvenience.

Again, another problem identified is that they all (batteries) in the remote control runs out and there is the need for replacement but most customers are not able to detect when the batteries run out and as such are not able to upload and download information as required further meter to work efficiently.

The study also found that comparing the use of the early prepaid meters (Smart Cash) with the recently installed ones (Electro-Cash Prepaid Meters) the lately type is more user friendly because one customer will just the prepaid meter Card to either upload or download information which easier to use that the use of remote control as in the case of Smart Cash Prepaid Meters. Due to this, most customers prefer that Electro-Cash Meters are installed for them rather than the Smart Cash Prepaid Meters.

The durability of the prepaid meters (16.4%) is another factor most customers consider before accepting the use of prepaid meters. Some prepaid meters are known to be durable than others, due to this, customers always want the known to be durable brands to be fixed rather than unknown brands. Its creates a problem for ECG and the meter

installation in officers in particular since installation of meters are done in batches with one type of meter in particular district.

Another factor affecting the acceptability and use of prepaid meter is accessibility to prepaid vending point. This constituted 10.2% of the responses. Some customers simply do not want to use Prepaid because anytime they run out of units, they are compelled to go to vending points to purchase units for use. Unfortunately, Accra West have only 87 vending points in the Region causing some customers to walk 10 yards distances and at times join queues before being able to purchase units for use. It was also found that most vending points do not operate 24 hourly services and as such the customer do not have the flexibility to purchase ECG units at any time the customers wishes to do so.

Another problem with access is the frequent internet network failures at the vending points. It was found that the vending M/C uses internet network to communicate to customer database and ECG database at main office and as such whenever the internet network is interrupted makes it impossible for the vending M/C to work hence customers inability to purchase units. Intermitted power outages are another cause affecting the use of the prepaid vending M/C. Since it is powered by electricity, based on all these problems associated, some customers prefer the postpaid meter to the prepaid meters, and as such refuses placement of their postpaid meters with prepaid meters.

The cost of installation (8.7%) is another factor preventing the acceptability and use of prepaid meters. Even though officially replacement of prepaid meters are without any charges, it is alleged that officers installing these meters normally demand some amount of money from customers before having their postpaid meter replaced with prepaid

meters. These authorized charges deter a number of customers from accepting prepaid meters. Since their old Postpaid meter are not faulty and there is no urgency for replacing them.

Another factor considered by 5.9% of the respondents is the availability of technical team to repair meter whenever it becomes faulty. The perception that the prepaid meters are not strong causes some customers to always think about how to repair them when they become faulty without inconveniencing the customer.

Inferring from the above, customers consider a lot of factors before accepting the prepaid meters for use. Among the common factors considered are the reliability of prepaid meters, user friendliness, and access to prepaid vending points.

4.5 MANAGEMENT STRATEGIES IN PROMOTING CUSTOMER ACCEPTABILITY OF PREPAIDMETERS

Management has adopted a number of strategies for promoting customers' acceptability of prepaid meter. The summaries of this are presented in table 4.7.

Table 4.7 Management Strategies in Promoting Customer Acceptability of Prepaid Meters

Respondents	Frequency	Percentage
Education of Benefits of prepaid meters	160	40.9
Free installation	82	21.0
Installation of durable prepaid meters	61	15.6
Increase vending point	57	14.6
Establishment of Emergencies response team	31	7.9
Total	**391**	**100**

From table 4.7 above, it was found that embarking on public education on the benefits of prepaid meter was the main strategy used by management to promote the acceptability on the use of the prepaid meter. The study found that management had prepared four set of flyers with each highlighting the importance of using the prepaid meter as against the use of the postpaid meter. The use of the mass media for instance the use of TV on documentaries highlighting the benefits of the prepaid meter was undertaken by management. In addition to this, the major FM stations in the study area were also used to inform the public on the benefits to be derived from using the prepaid meter.

The Marketing Section in conjunction with the prepaid section also undertook a number of public educational programmes in the form of community durbars and public announcement on the importance of prepaid meter. The study found out that all these educational programmes were undertaken prior to the installation of the prepaid meters. The study found that opinion leaders and gate keepers of communities were duly informed and involved in the public education.

It was found that due to the intensified public education on the use of the prepaid meters; a lot more people have expressed interest in changing their meters from postpaid meters to prepaid meters.

Installation of durable prepaid meters is another strategy management adopts in promoting prepaid meter usage (15.6%). It was found that before the introduction of the use of any type of prepaid meter, the Research and Development unit undertakes a thorough study on the durability of the prepaid meter before its. The study also found Meter Test Laboratory has been established with the main function of picking samples of imported meters and testing to see that they meet the standards required in Ghana. All these feasibility studies are to ensure that the meters provided to customers are durable, and this measure is to help avoid a situation where after installation, a major defect will be identified such that these meters are recalled.

Management decision to increase vending points (14.6%) was seen as a strategy in promoting the acceptability of prepaid meter. Management decision to sublet the sale of units to private entrepreneurs rather than to sell by their own staff was a major decision aimed at increasing access to vending centres. The study found that most customers fell reluctant to use prepaid meter because those who have installed the prepaid meter are faced with the problem of walking long distance to ECG's sale outlets in order to buy units. The study found that prior to the introduction of the prepaid meter.

Accra West had only 12 cash points and with the introduction of the prepaid meter these cash points were the main vending points for prepaid meter units in the study area. The

introduction of the use of private vendors in the sale of units for prepaid meter users had led to as high as 87 vending points in the Region helping to improve access to the sale of units to prepaid meter users.

Free installation of prepaid meter (21%) was seen a major strategy for promoting acceptability of prepaid meter use. The study found that management has decided to make the installation of prepaid meter free of charge to attract customers who are already using the postpaid to call for free installation of prepaid meter. It is the wish of management that all postpaid meters are phased out because of the high cost involved in its use such as engagement of meter readers, production and distribution of bills and disconnection of defaulting customers. The study also found that management has set up monitoring unit who amongst its duty is to ensure that policy of free installation of meters is strictly adhered to by field officers.

Management ability to establish an emergency response unit to address defects and problem associated with the prepaid meter usage by customers on time is another strategy for responses. The study found that the emergency response team who are mainly technical officers trained in resetting the meters and replacement of faulty meters and cards. The ability of such unit to respond quickly to customers' demands has also attracted some customers to use prepaid meter.

Management has adopted a number of strategies for promoting customers acceptability of prepaid-meters and the main strategy include public education on the benefits of prepaid-meters, the installation of prepaid meters and the installation of durable prepaid meters.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The study examined customers' perception and acceptability on the use of prepaid meter in Accra West Region of ECG. The aim of this study was to improve customer acceptability by determining the level of acceptability of prepaid meters, analyze the factors customers consider before accepting the use of prepaid meter, and determine management strategy in promoting prepaid usage.

Research design adopted for the study was the descriptive method. Both primary and secondary sources of data were used with questionnaire as the main instrument for collecting primary data on customer acceptability, factors customers perceive before accepting the use of prepaid meters.

The stratified sampling method was used to categorize customers into the type of tariff whether domestic or commercial. A total sample size of 391 were drawn out of 18, 0000 customers in a district.

5.2 CONCLUSIONS

This subsection presents the conclusion of the study. These conclusions are derived from the findings which are based on the three objectives of the study; level of acceptability of the prepaid metering system among customers in the Accra West Region of ECG, factors customers consider before accepting the prepaid meters and the strategies in promoting customer acceptability of the prepaid meters.

The conclusions to be drawn were shaped by the following findings of the study:

1. There are more male customers using the prepaid meters than female in the study. The likely reason for this is that there are more landlords than landladies in the study area.
2. The education level of those using prepaid meters in Accra West Region are high with majority of them having tertiary level education. This is due to the fact that these category of people understand the benefits to be derived from the prepaid meters as against the old postpaid meters. Hence then high level of acceptability among such customers,
3. Majority of customers have used prepaid meters between one to four years and based on its have a clear understanding of how the prepaid meters work.
4. There is a general perception that prepaid meters are fairly acceptable to customers in the study area because of problems associated with user friendliness and durability of the prepaid meters being installed.
5. Customers consider a number of factors before accepting the prepaid meter. The main factors include reliability of the prepaid meters, user friendliness, durability and access to prepaid metering vending points. These inherent characteristics promote the usage of the prepaid meters since the availability of these makes the prepaid convenient for use.
6. The main strategies management adopt to promote customer acceptability of prepaid meters include education on the benefit of using prepaid meter, installation of durable prepaid meters, free installation and increase of vending points.
7. A minor strategy being adopted by management in promotion of customer acceptability of prepaid meters is the establishment of an emergency response unit

and the recruitment of more field officers in order to address all technical issues customers may have promptly. From the above, it can be concluded that majority of the respondents have the perception that the use of prepaid meters are not acceptable because of the numerous problems associated with it.

From the above, it be concluded that majority of the respondents think that the use of prepaid meters are not acceptable because of the numerous problems associated with it. Key among such problems are issues concerning cost of installation, friendliness of the prepaid meter and durability and reliability.

5.3 RECOMMENDATIONS

Based on the findings and the conclusions drawn, the following recommendations were made:

1. Since there were more male customers than female ones in the study area and the fact that there are more male subscribing to use of prepaid meters than their female counterparts, it is being recommended that management should refocus their public education on the use of prepaid meters on women in order to get a lot more women to subscribe to the use of prepaid meters. Its education can motivate female landladies who normally register their property in the name of their husbands to register their property in their own names so that they can subscribe and use the prepaid in their facility.
2. There is the general perception that prepaid meters are fairly acceptable to customers in the study area. This perception suggests that the acceptability level is quite low. As a result of this management should intensify public education as well as improve on the efficiency of prepaid metering services in order to increase the acceptability level of customers by addressing their concerns in terms of

installing durable and reliable prepaid meters also acquiring prepaid meters that are user friendly and increasing prepaid meter vending points.

3. Customers consider a number of factors before accepting the use of prepaid meters. Among the key factors are the user friendliness, durability and access to prepaid vending point. It is therefore necessary that management improves on such factors in order to improve the acceptability on the use of the prepaid meters.
4. Management should not only rely on major strategies of promoting acceptability such as education on benefits on the use of prepaid meters, free installation, increase vending points but should also emphasized on the need to establish an emergency response unit that will attend to all technical emergency issues relating to prepaid metering issues promptly.

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APPENDIX

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

INSTITUTE OF DISTANCE LEARNING

QUESTIONNAIRE

This questionnaire intends to collect information on customers' perception and acceptability on the use of prepaid metering system in Accra West Region of Electricity Company of Ghana. Thank you for contributing towards the success of this research.

HOW TO COMPLETE THE QUESTIONNAIRE

Most of the questions seek response by ticking in the box that corresponds to the appropriate answer. Other questions demand that you provide your own responses.

SECTION A: Social Demographic Profile of Respondents

1. What is your gender?

   ☐ Male

   ☐ Female

2. In which age group do you belong

   ☐ 20 – 29

   ☐ 30 – 39

   ☐ 40 – 49

   ☐ 50 – 79

3. Which level of education do you have?

☐ No Formal Education

☐ Primary/JHS

☐ Secondary/SHS

☐ Tertiary

☐ (Specify)…….....

4. How many year have you been using prepaid meter (s)?

☐ Less than 1 year

☐ 1 – 4 years

☐ 5 – 9 years

☐ 10 years and above

5. Which of these categories of users do you belong?

☐ Residential (Domestic)

☐ Non-residential (Commercial)

SECTION B: Customers' Perception on Acceptability of Prepaid Meters

1. What do you think about the level of acceptability of prepaid meters in your locality?

☐ Very acceptable

☐ Acceptable

☐ Fairly acceptable

☐ Not acceptable

☐ Indifferent

2. Give reasons for your answer in question 1 above.

……

……..

……..

SECTION C: 6 **Factors Customers Consider Before Accepting Prepaid Meters**

1. Do you have a prepaid meter?

☐ Yes

☐ No

2. If yes to question 1 above, what factor did you consider before accepting the meter?

☐ Reliability of Prepaid meters

☐ Unreliable financial report of vendors

☐ Durability of prepaid meters

☐ Accessing to prepaid vending points

☐ Cost of installation of prepaid meters

☐ Availability of technicians to repair faults of prepaid meters

3. If no to question 1 above, would you want to use one?

☐ Yes

☐ No

4. Please give reasons for your answer in question 3 above

……

……

……

……

SECTION D: **Management Strategies in Promoting Customer Acceptability of Prepaid Meters.**

1. Do you think the management of ECG is doing enough to promote the use of prepaid meters?

☐ Yes

☐ No

2. If Yes to question 1 above, Explain what they are doing.

……

……

…

……

….

2. If No to question 1 above, which of these strategies would you recommend the management of ECG to put in place in order to promote the use of prepaid meter?

☐ Education of Benefits of Prepaid Meters

☐ Free installation

☐ Installation of durable Prepaid Meters

☐ Increase vending point

☐ Establishment of Emergencies Response team