

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI,  
GHANA

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ASSESSMENT OF PREPAID METERING SYSTEM IN GHANA: CONSUMER  
PERCEPTION ANALYSIS.

By

ERICA ADJEI ABABIO

(PG1095017)

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award degree of

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## DECLARATION

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Erica Adjei Ababio

.....

Student

Signature

Date

**Certified by:**

Dr Edward Brenya

.....

Supervisor

Signature

Date

**Certified by:**

Dr. Bob George Millar

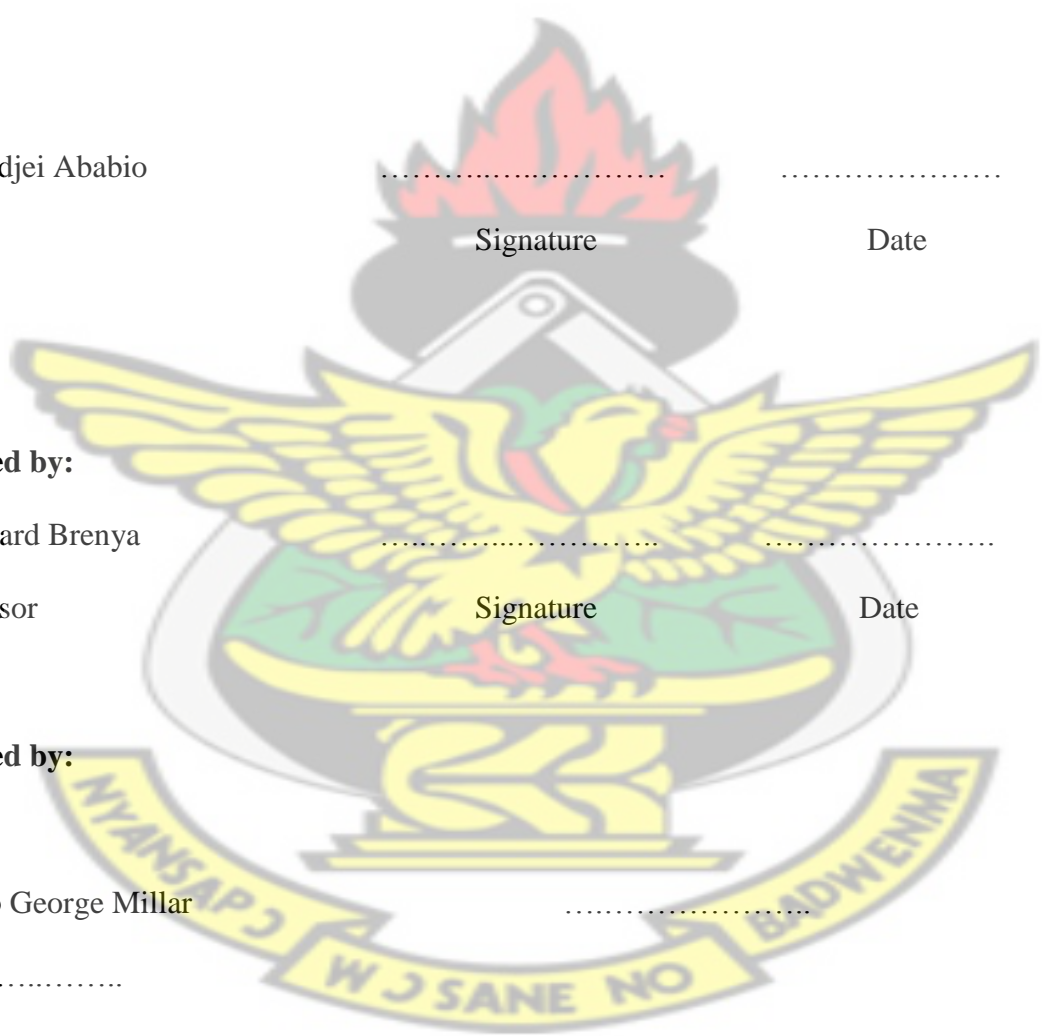
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Head of Department

Signature

Date



## DEDICATION

I dedicate this project work to my family, especially my mum Miss Vida Agyeiwaa Boateng who has encouraged me from the start to finish and whose encouragement has made sure that I give it all to finish what I have started and to my friend who has always being like a sister to me, Miss Gifty Oforiwaa Asubonteng who has been affected in many ways possible by this quest, and all my friends who supported me in one way or the other through my education. May the Almighty God Bless you all.



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May the Almighty God bless you.



## ABSTRACT

The energy sector over the years has witnessed initiated policies to increase customer satisfaction while at the same time solving the problems of administrative inefficiencies in the operation of the sector. This therefore erupted the need to come out with an alternative means of billing the electricity consumption of the consumers, hence the emergence of the prepayment meter system. The study assesses Consumer perception about Prepaid Metering System in Ghana: A case study of the Ejisu District within the Ejisu-Juaben Municipal Assembly in the Ashanti region of Ghana. The study adopted a quantitative approach. The research population focused on prepaid meter users of Ejisu district out of which a sample size of 51 was sampled for the analysis. The sources of data were mainly primary source. The researcher adopted purposive and convenient sampling techniques in soliciting information for the study. Statistical package for Social Science (SPSS) and Microsoft excel was used in analyzing the data. The study established that, with the introduction of prepaid meter, consumers are now careful with the consumption of electricity, payment has reduced drastically; customers again buy credit at their own convenience and do not fear any disconnection, they don't pay any money when they don't use the meter, no more disappointment when one is uncertain how much to pay when post meters are disconnected and no need to pay for re-connection. Again findings revealed that, efficiency, no accumulated debt, ease of purchase, paying upfront, quick response, and post payment meter ease the use of prepaid metering. Furthermore, not convenient use, blackout, spending more money, fight over sharing of bill, difficulty in pre financing, disadvantageous to the poor and less education were the challenges encountered by customers in using prepaid metering. The study recommended that, more education on the use of prepaid metering should be intensified so as to inform customers about the need for them to switch to the prepaid metering system and this should be done diligently in order to avoid any misinformation and its subsequent effect on consumer's perception.

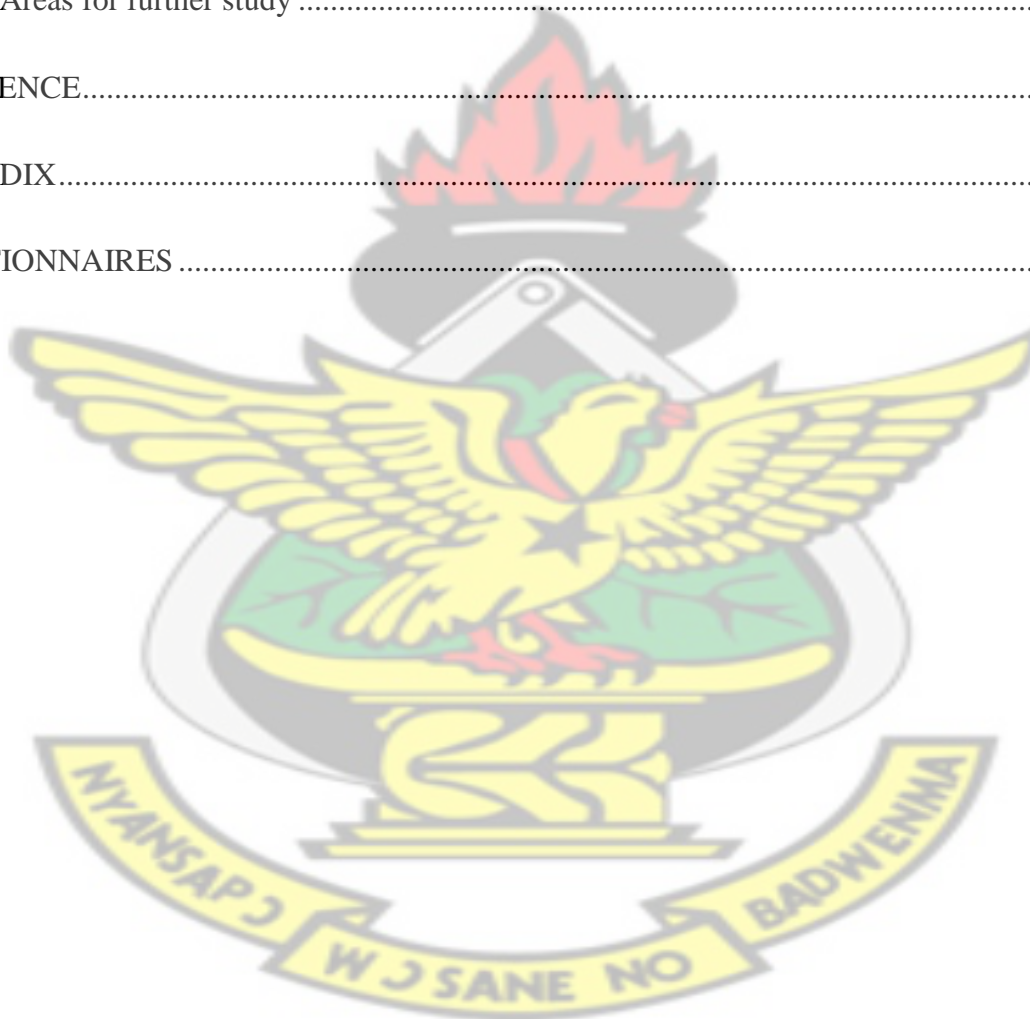
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## CHAPTER ONE

### INTRODUCTION

#### 1.0 Introduction

This study seeks to introduce and give an exposition to the research study on “*Assessment of Prepaid Metering System in Ghana: Consumer perception analysis*”. This chapter presents an introduction into the topic which includes the background of the study, problem statement, research objectives and questions, significance of the study, the scope of the study, brief methodology, limitations of the study and organization of the study.

#### 1.1 Background of the study

Governments are increasingly seeking low-cost ways to curb residential energy use (Nugroho et al., 2017). Households are an important group when considering the design and implementation of energy saving programs (Benders et al., 2006). Many energy consuming activities take place within households, and a large part of the accompanied energy requirements can be attributed to residential uses. These uses can be classified as direct (energy for space heating or cooling, electricity, and vehicle fuel) and indirect. Indirect energy requirement is defined as the energy needed for production, distribution, and waste disposal of consumer goods and services (e.g. the production of food). Understanding household energy usage is therefore vital for energy consumption and conservation. Energy in the home is determined by the technical and architectural characteristics of the house and its heating/cooling system, on the one hand, and the behaviour of the resident, on the other hand (Raaij, 1983). The technical architectural characteristics will determine in-home energy savings. Other influential factors are the number of rooms in use as well as orientation towards sun and wind (ventilation). Many researchers have further pointed out that changing lifestyles is important to reduce the energy consumption

(Kondo, 2007). The other factor, household behavior in purchase-maintenance and usage-related energy behaviour, determine the energy use in the home (Raaij,1983). The purchasing-related behaviours refer to owning of home appliances which consume energy. Various policies have been proposed to facilitate and promote energy conservation at the household level in Ghana.

The use of smart meters is considered a first step in allowing consumers at the household level to control their energy consumption (Chou and Yutami, 2014). The energy information through a display system can influence household energy behaviour (Wood, 2007). Interventions such as a payment system for home electricity consumption also may play a significant role in energy consumption decisions (Yamamoto et al, 2008). An investigation of home display of real-time energy consumption and prepayment metering system at 12 pilot studies shows an increasing awareness on electricity consumption from households (Faruqui et al, 2010). The State Electricity Company of Ghana (ECG) implemented a prepayment system for newly built homes and encouraged the use of post-paid system to convert the system to a prepayment system. One important reason behind the introduction of this system was promoting conservation to close an electricity deficit and simultaneously reduce the energy losses due to electricity theft in Ghana.

The Ghanaian prepaid system requires households pay upfront for their electricity as the meter tracks consumption and credit. By enabling users to see the relationship between energy use and costs, the metering system is intended to promote energy savings behavior. However, 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. Further, it is still uncertain whether those joining the program will actually

save energy. Identifying which kinds of households are most likely to join the program and then save energy are important considerations as policymakers contemplate further reforms to Ghana's prepaid system. 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 (Quayson-Dadzie, 2012). 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).

## 1.2 Statement of the problem

In Ghana, prepaid metering was introduced by the Electricity Company of Ghana (ECG) in order to reduce collection expenses, eliminate bad debts and efficient cash flows with an overall aim of improving the financial position of the company (Azila-gbetor, 2015). Azila-gbetor (2015) further explained that, despite the benefits reckoned by ECG in enticing consumers in accepting the new prepaid meter policy, majority of consumers have contrary opinion regarding the usage of prepaid meter. Furthermore, a study by Quayson-Dadzie (2012) revealed that there is a general assumption among consumers 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. Most researchers such as Mwaura (2012) have focused on the benefits of prepaid metering to utilities providers of which ECG is among. For example, Mwaura (2012) identified the reduction of non-technical losses for utility providers. Other researchers also looked at reduced financial risks, improved customer services, energy conservation, improved operational efficiencies, improved government or corporation revenues and spurring investment in the electricity industry (Ghajar and Khalife, 2003; Tewari and Shah, 2003; Bandyopadhyay, 2008; Khan *et al.*, 2010; Ogujor and Otasowie, 2010; Mwaura, 2012). However, given the less attention to the perception of customers on the usage of prepaid metering system, this current study contributes to academic knowledge by evaluating the perception of customers on prepaid metering within the Ghanaian context given that consumers are the receivers of the prepaid metering service.

### **1.3 Research objectives**

The general objective of this study is to determine the perception of customers in the usage of prepaid metering system in Ghana.

#### **1.3.1 Specific objectives**

1. To examine the perceived usefulness of prepaid metering system in Ghana.
2. To determine the perceived ease of use of prepaid metering system in Ghana.
3. To identify the challenges confronting the success of prepaid metering system usage in Ghana.

#### **1.4 Research questions**

1. What are the perceived usefulness of prepaid metering system in Ghana?
2. What are the perceived ease of use of prepaid metering system in Ghana?
3. What are the challenges confronting the success of prepaid metering system usage in Ghana?

#### **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. Again the study is expected to contribute to academic knowledge by contributing to existing literature to enable academicians, researchers, scholars and other stakeholders interested in this study area.

### **1.6 Scope of the Study**

This study is limited to the residential (domestic) customers of ECG with particular focus on Ejisu district within the Ejisu-Juaben Municipality. Ejisu district was chosen because of its closeness and ease of access to consumers by the researcher. Additionally, Ejisu-Juaben Municipality was selected because it is a hub of commercial activities in Ghana where prepaid meter system is well served. As part of the economic activity in the Municipality, it harbors some of the consumers of ECG that utilize prepaid metering system. Thus ECG has a high client base and more active within the Ejisu-Juaben Municipality. The study will not analyze specific views of individual but a holistic response on the various subject matter. It excludes customers using other form of metering to access electricity services. Also the study was limited to customers who have been using prepaid metering at least, for the past twelve months.

### **1.7 Brief methodology**

The total population of the study area is estimated at 963 customers who are using pre-payment meters of ECG in the Ejisu district within the Ejisu-Juaben Municipality. A sample of 51 was selected. The research adopted purposive and convenient sampling methods to select customers. The main data collection tools were questionnaires. The study used SPSS software to code the questionnaires and employed descriptive statistics (mean and standard deviation) analysis technique to achieve the research objectives. The variables that were used in measuring *perceived usefulness* included: careful of consumption, pay less, fear of disconnection use of meter without money, no disappointment and no disconnection, No payment of re-connection fee. The variables that were used in measuring *perceived ease of use* included: efficiency, no accumulated debt, ease of purchase, paying upfront, quick response, and post payment meter. The variables that were used in measuring *challenges* included: not convenient use, blackout, spend more money, fight over sharing of bill, difficulty in pre financing, disadvantageous to the poor and less education.

### **1.8 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, within the Ejisu District use prepaid meters. The researcher had to rely on the District's prepaid vending point to administer questionnaire to customers who came to buy prepaid units.

The study also had difficulty in getting adequate responses. 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.

### **1.9 Organization 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, limitations and organization 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

### LITERATURE REVIEW

#### **2.0 Introduction**

In order to understand prepaid metering system and its impact on consumer satisfaction and perception, Systematic reviews of previous related past studies on prepaid metering system, consumer satisfaction, benefits and challenges of prepaid metering system, appreciation and its influence on consumer satisfaction have been presented. Theoretical framework of the study was also not left out.

#### **2.1 Theoretical framework**

Significant area of theory used to explain household energy use are models of behavioral change. Though these behavioral models tend to differ broadly by concepts, theory, and applications (Axsen and Kurani, 2012) they are necessary to understand what consumers do, and why they do so. Behavior in this sense is not the consumption of energy in itself but rather a consequent of behaviors such as turning the lights off or buying more efficient household appliances (Becker *et al.*, 1981). For this study, we zero in on behaviors which relate to direct energy requirements such as curtailment behaviors (Dwyer *et al.*, 1993; Abrahamse *et al.*, 2005). The sociotechnical approach of behavioral change was adopted for this study. The sociotechnical model argues that there is a close relationship between behaviors and infrastructure i.e. energy infrastructure (e.g. smart grids) (Shove, 2010). The sociotechnical models go beyond how people's dispositions and behaviors are influenced by others and propose that objects and technologies have an inbuilt tendency to cause the user to behave in certain ways (Guy, 2006). Different objects or technologies tend to work together in technological systems which then permit or encourage certain behaviours and lifestyles. These lifestyles in turn create the need for further technologies

to reinforce the lifestyle. This is why the idea is called sociotechnical. This approach acknowledges the active role that metering technology has in mediating the relationship between energy suppliers and households (Akrich, 1994). This idea also supports the view that metering of energy consumption though complex, can influence the energy behavior of consumers and lead to a conserving behavioral effect (Graham and Marvin, 1994; Hand *et al.*, 2005; Stephenson *et al.*, 2010; Brunner *et al.*, 2012) and also act as a “gatekeeper” to utilities (Marvin *et al.*, 1999). Thus the socio-technical perspective suggests we should understand behavior as the outcome of a mutually reinforcing system of technologies, ideas, behaviors and institutions.

## **2.2 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 Jagersfontein (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 Jagersfontein 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 experienced 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 250,000 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 a 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 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 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 guy’s 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”

### **2.3 History of Billing System for Revenue Collection by Electricity Company of Ghana (ECG)**

Revenue collection has long been a bane of ECG under the postpaid system where meters are read, captured and bills are produced. Several methods were engaged over the years by the utility provider in an attempt to ensure efficiency in revenue collection. This ranges from cash offices and pay points, banks, third parties and revenue collectors also called “bonded cashiers”. The bonded cashiers are private individuals who operate in the rural and semi-rural areas where ECG has no pay points or cash offices to collect payments. Even though this strategy to some extent has been successful, they have not been entirely effective in preventing payments evasion, revenue leakages and numerous challenges that consumers face: untimely delivery of bills and crediting of bills paid to customers’ accounts, delivery of bills to wrong person, inconvenience of travelling long distances to make payment (Mensah *et al.*, 2012).

To improve revenue collection and simultaneously solve the myriads of consumers’ problems, ECG turned to prepaid metering system. This system was initially adopted on pilot basis between 1994 and 1995 with the use of “cash power” in parts of SSNIT flats at Sakumono Accra, Tema and Kumasi for residential and commercial consumers with small loads. It was finally introduced in 2005 after several years of testing. Today, this service has been extended to all major cities, metropolis, Municipal and districts’ capitals because of its associated benefits such as reduction in revenue losses and illegal connections, energy conservations etc. to the utility provider. The variety of meters used in Ghana is produced by Ghana Electrometer, the largest single producer of meters in Ghana.

As at 2013 ECG has about 30% of its total customer population using prepaid meters and is in the process of extending it to districts that qualify (ECG, 2013). A new metering technology known as Smart-G is being introduced under a new partnership between Ghana Electrometer and

ECG. This meter would enable customers purchase and use power like mobile phone recharge system. With this system ECG would provide scratch cards that can be bought from vendors anywhere, thereby offering the customer comfort and choice in the purchase and consumption of power. It would also improve ECG's efficiency and cash flow.

### **2.3.1 Billing System and Revenue Maximization**

Though the aim of every utility provider is to provide efficient service to its clients, in developing countries low-income levels continue to pose a daunting challenge especially in terms of cost recovery (Sualihu and Rahman, 2014). Bill payment and collection efficiency also referred to as "headline efficiency" which supports adequate service provision according to Kayaga *et al.* (2004) are generally poor; thus below 50% cost of production in Africa. This inefficiency in billing and revenue collection are mostly due to (i) incidence of undercharging and overcharging due to billing errors, (ii) creating dissatisfaction among consumers (iii) inefficiencies in the billing system; (iv) failure to establish customer base; (v) irregular bill delivery resulting in non-payment by registered clients (Chipofya *et al.*, 2009).

Misra and Kingdom (2012) contend that meter reading and billing errors, whether involuntary or resulting from fraudulent practices, should be eliminated by limiting the human handling of data through the adoption of efficient billing systems. In support of Misra and Kingdom (2012), Ogujor and Otasowie (2010) suggest prepaid system ensures adequate and proper billing of customers even though Oracle (2009) is of the view that consumers are not in favour of the prepaid system because of its cost, fairness and health and safety concerns.

However, empirical studies using prepaid meter from several studies shows an improvement in revenues by utility organizations through better billing and collection processes. For example, in the water sector, a study by Kingdom *et al.* (2006) in São Paulo Metropolitan Region of Brazil

concludes that Companhia de Saneamento Básico do Estado de São Paulo (SABESP) has greatly increased their revenue by Brazilian reais (R\$) 172m equivalent of US\$ 72m through better metering and billing of certain key customers. A similar study by Agrawal (2008); Babel and Rivas (2012) on Thailand water utility sector provided by Metropolitan Waterworks Authority (MWA) shows an improved revenue to a sustainable level as a result of implementation of new billing and collection practices. As a result of such practices the overall financial performance of MWA was on a positive trend in between 1998 and 2008 (Rao, 2012). Babel and Rivas (2012) cited in Rao (2012) conclude that such figures indicate the sustainability of utility operations as costs are comfortably covered by revenues. Other countries with notable improvement includes 15% increase in revenue collection in Satkhira, Bangladesh (World Bank, 2012) and 96% cost recovery in Burkina Faso (Agrawal, 2008) following the installation of individual water meter. Regarding electricity, a study by Casarin and Nicollier (2008) among local electricity users indicate that prepaid meters lead to improved consumer welfare and reduction of arrears in accounts receivables, operational and financial costs on the part of the service provider and better allocation of resources for the user. Similarly, a study by Mwaura (2012) in Rwanda about electricity prepayment billing system shows that revenue rose in tandem with the increased number of EPBS enrolment, from US\$ 261,000 in 1996 to US\$ 22.9m in 2008. Other associated benefits discovered include increased and timely revenue collection and improved services delivery to electricity users.

Alongside issue of efficiency in revenue generation, Kettless (2004) states that the prepayment system has been used in the United Kingdom (UK) for more than 80 years and that the system was developed as a way of dealing with bad debts. However, Tewari and Shah (2003) and

O'Sullivan *et al.* (2014) argue that it also affords customers the opportunity to avoid the build-up of debt which would be the case in the post-paid billing system.

#### **2.4 Customers satisfaction with prepaid meters**

The consumers in every company or organization are very key and essential for the success and growth of the economic activities and its subsequent incline in the organizational success (Fornell *et al.*, 2010). It was further pointed out that in a situation where consumers' spending dwindle, then the economy will equally experience slow growth as well and when the consumption level of customers falls greatly, the economy will experience marginal contraction as well. Hence marketers are to quickly try as much as possible to identify customers' want and satisfy them profitably and anything contrary to this will lead to dissatisfaction of customers thereby leading to massive defection (Chezy and Itamar, 2007).

Satisfactions of customers are most often than not a mindset emanating from whether the customers are satisfied with the company's product or not. And for companies to either meet or exceed customer's wants, innovation then becomes necessary and vital. And innovation can be introduced either gradually or rapidly, and rapid innovation are usually driven by the desire of customers for an improvement on the product or services and that can enhance the performance with convenience while the rapid or radical form of innovation is usually economic and technologically driven by the companies desired to become leaders or be ahead of its competing companies (Vercauteren, 2008). The development of innovation should aim at providing a very positive views and perception being seen as the incremental new ways of doing things which drive the perception of customers rather than the radical innovation which is largely based on the drive by a technology (Wijmans, 2001, O'Connor, 2001).

A major prominent level of satisfaction that the customers enjoy from the adoption of prepayment meter usage or system is the payment before usage and it largely assists the customer to feel comfortable and get maximum satisfaction. The prepayment electricity usage require the users pay before the usage of the energy and its consumption is also being controlled by the prepaid meters which are usually mounted on walls in the house (Subramoney, 2007). Usually the prepaid meters must have credit loaded on it before the customer can effectively enjoy the electricity usage. Baptista (2013) was of the view that the prepaid electricity gives consumers the power to control the electricity usage and how to purchase the credit periodically and consumers further enjoy empowerment in the prepayment meter usage as compared to the post credit meter usage. Especially as in the case of Mozambique as per the urban dwellers, they welcome the prepaid meter usage massively as they felt empowered.

With the introduction of prepaid meters, the consumers have it very easy to monitor and subsequently manage their proposed budget for a specific period of time thereby reducing unnecessary spending and unwarranted cost (Tewari 2003). Prepaid meter usage largely benefits the household and the company through its improvement in profit by effective revenue collection systems as well as reducing the cost incur by the service providers in terms of bad debts which characterized the traditional system (postpaid) of getting power, especially the post- paid metering system and also improving and maintaining such an effective customer relation between the consumer and the service provider (Harvey, 2005).

Another prominent advantage of the prepayment meter usage is the safety that the employees of the ECG enjoy since postpaid is very hazardous work and exposes them to danger at any point in time. Usually meter readers who most often than not pay frequent visits to the consumer's

residence for reading meters are usually been exposed to dog bite and other forms of harassment and perception of invading in the privacy of the consumers (Jain, 2011).

Meanwhile in most cases, the consumers reach their peak or highest level of satisfaction even with just the communication of the change process to them at any point in time. According to Miyogo, et al (2013), if the change process is so huge or incremental, then there is the likelihood of resistance since majority of the consumers are still comfortable with the old systems of metering. It is obvious that some level of resistance will remain underground and will not surface at the early stage because they need to gather momentum. Miyogo, et al (2013) believed that, it is obvious that the process of change is usually applicable to any management level within the organization especially the various departments that are engaging in changing from one way of doing things to another or one level of customer service to another. Hence the drive to change from the post- paid to the new prepayment system obviously required a fundamental change of management in order to ensure a smooth transition from receiving bills at the end of the month to a state where prepayment credit is purchased to power the meters. And with the fulfillment of the change, the customers' ways of thinking and the olden system of operation also need to be worked on seriously in order to change the mindset of the customers (Hocutt, 1997).

The perception about how quality in services has affected the level of satisfaction of the consumers and their behavior towards complaints. Services that come from some essential element concerning the perception of the product are important as for as level of satisfaction is concerned. According to Kelley and Davis, (1994) when considering change management, then the expectation of customers and ways and means of getting or achieving the expectation should be critically considered. And as such, the management has to put measures in place in order to execute effective plans, and implement the plans and go further to put measures in place to

monitor and control the exact services offered in order to do away with any service gaps. In reality, the service perceptions are the overall total of the various services which include how responsive the management is towards satisfying the consumers, how reliable they are in terms of delivering on time, and the assurances received from the service providers.

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## **2.5 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 ourselves 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 have 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 (Rexrichie, 2011).

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 prepaid.

Northern Ireland Electricity says that prepaid customers use 4.9 percent less electricity than the 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 returns 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

## **2.6 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 and Luciana , 2008).

### **2.7 Benefits of the prepayment meter usage**

The prepayment meter usage has presented the customers with a variety of benefit and merit for both the customers and the service providers of the electricity. Judging from the economic point of view, one can confidently point to the fact that the prepayment meter usage has accounted for mixed reaction and financial fortunes to both energy providers and the consumers at large (Tewari and Shah, 2003). A typical example was given and it is indicated that prepayment usage may end up in decrease in metering, billing the consumers and subsequently in disconnecting

and cost involve in connecting the customer back are all cost to the power provider. And this was specially introduced with the principle that consumers usually effect payment prior to the electricity consumption, which has led to a significant improvement and progress in revenue generation and eventually leads to decrease in working capital or the cost involve in doing the transaction.

On the part of the consumers, the system could result in a thorough understanding of how energy consumption takes place, having proper control of energy use and finally prudent budget management and control in order to avoid waste of the energy supply and the cost used in purchasing it. Truly some cross section of observers has challenged that a significant or a major key attribute of prepaid meter usage is that the implementation in some areas and communities has help immensely to limit the level of arguments and confrontation that usually ensue between individuals of the same household, and the local utility providers and the customers who mostly patronized the prepaid meters (Bond, 2007).

Nonetheless, the issue of revenue collection or payment of electricity bill has been a serious challenge to ECG all over the years especially under the old system of postpaid whereby this meters are read on monthly bases, the result then captured and several processes and procedures are used to come out with a bill for consumers to pay and under this system, several mechanisms were put in place to reduce the level of inefficiency and hence produce better result in order to achieve efficacy and sound result which can lead to improve operation of the system and prudent revenue collection (Bond, 2007). The system usually emanates from the offices of the ECG, the various pay points, affiliated banks, inclusion of third parties which include revenue collectors which is often called the bonded cashiers, and these are all private individuals and institutions

who usually do operate in both rural and partial rural areas especially in various joint where ECG do not have any point of pay cash offices to collect revenue from the consumers.

Despite the fact that the strategy has to a large extent yield fruitful result, yet still there are means by which some run away from payment, there are loopholes where revenue leaks and some other serious challenges that the consumers on daily basis face. Among the challenges are, delay in disbursement of bills on timely bases, crediting of bills normally paid to the customer's account, giving wrong bills to individuals and above all lack of proximity to sales and revenue points (Mensah et al 2012). In order to enhance revenue generation and collection whiles at the same time tackling consumer's challenges, has led to the introduction of prepaid metering system. The system was previously adopted and implemented on pilot basis between 1994 and 1995 through the use of cash power especially in some part of SSNIT flat, Adenta and Sakumono in Greater Accra region of Ghana, Tema and Kumasi for both commercial and residential consumers whose electricity consumption is usually small through several years of rigorous testing. As at today, the services have been extended to almost all the big cities and urban areas, in Municipal and districts capitals due to the numerous benefits that accrued to the providers in the form of massive cut down on revenue losses, acute curtailment on illegal connections, as well as conserving energy to the utility provider (Quayson Dadzie, 2012). The prepaid meter will assist the customers to buy and use the electricity power just like how consumers buy scratch card to recharge their phones.

Through the emergence of this system, ECG would be able to make the scratch cards available to their customers through their vendors or at any point of sales and this has enable the customer fill comfortable in the consumption of electricity power. Again the efficiency and cash flow management of ECG's operation will be improving from time to time (Quayson-Dadzie, 2012).

And moreover, systems need to be put in place in order to achieve accountability and result. With regards to accurate billing of customers, equity and fairness and also to tackle issue of health and safety concern of both the domestic and industrial utilization of prepaid, proper and sound systems are put in place to achieve this process (Ogujor and Otasowie, 2010). 25

However, studies through the use of prepaid meter revealed that there is a significant improvement in revenue generation by utility providers or companies through accurate and proper billing of customers and revenue collection processes most especially in the sectors such as the water. A study conducted by Kingdom et al (2006) in Thailand concerning the water utility department or sector was provided by the metropolitan waterworks Authority (MWA) indicated a significant improvement in revenue generation even to some sustainable level as through the implementation of the new billing and revenue collection processes and practices. With the resounding result out the various practices, the entire financial prudence and performance of the company was on the positive direction especially around 1998 and 2008 (Rao, 2012). This truly shows that the sector with the sound and effective policies, can be maintain and sustain and this is because the revenue accrued has exceeded the cost or expenditure incurred and this indicated that the sustainability of the utility sector is perfectly assured as the cost incurred in mobilizing the revenue are comfortably covered by the excess revenue (Rao, 2012).

There are some other benefits that have been noted and among this include improved and timely collection of revenue and prompt delivery of services to consumers of the electricity power. Concerning efficiency in ways of mobilizing revenue, it is evidently clear that the prepayment system is a right step in a right direction so that service providers are constantly checking every loophole so as to increase the efficiency it requires (Kettles, 2004). Further studies have also

pointed out that the prepayment system has once again work effectively even in the UK for close to 80 years and it was established that the system has improved as a means of solving bad debts. Meanwhile the prepaid meter usage extensively enables customers to desist from procrastinating the payment of overdue bills as it happened in the case of post-paid method of billing customers (Tewari and Shah, 2003 and O'Sullivan et al. 2014).

Another model called the socio-technical was of the view that there exist a cordial or very close relationship between the behaviors of the consumers and the energy infrastructure and this infrastructural system is to boost the provision and utilization of the energy supply to its consumers (Shove, 2010). In all human entity, the behavior of some individuals can influence them either positively. And there is a strong believe that the socio-technical models have exceeded the way individual's attitude and ways of life can substantially be influence by other people through proposed technologies has some tendency to change the user of prepaid to behave in a particular way (Guy, 2006).

Meanwhile, there are different system of technologies that can work together in other technological systems that usually allow or ginger some particular lifestyles and attitudes and this later in other angle to reinforce the exact ways of life. This explain the reasons why the idea is called was name socio-technical and this particular approach has known the significant role the metering technological system has in mediating and coordinating the familiarity between the energy providers and the members in the community (Akrich, 1994). The big idea again back the view that despite the fact that applying the prepaid metering system to energy used or consumption even difficult and tedious, it can effectively influence the behavior of energy consumers in a given community which in the long run lead to energy conservation attitude and

also equally acts as a security or security provider to utilities (Graham and Marvin, 1994; Hand et al., 2005).

### **2.8 Challenges of prepayment meter usage**

From the foregoing, it is important that the views of employees and consumers of energy regarding the ongoing transition from postpaid to prepaid electricity billing system are critically examined. The relevance of consumers and employees of the energy provider is inherent in the fact that these changes might be highly correlated with changes in their welfare and the fact that they are also a relevant factor behind the success of any change in the organization. While it is appreciable that progress can only come through change, not everyone including the beneficiaries of such progressive change are willing and ready to embrace change. On the contrary, it is widely believed that most would resist change (Duck, 2004). Nevertheless, previous studies indicate that prepaid meters are not necessarily a well-received innovation in some segments of society, to the extent that in some cases, society as a whole is reluctant to adopt the system (Tewari and Shah, 2003).

The introduction of prepaid billing system in Argentina was received with much skepticism, with many arguing that it was meant to exploit them. But why even progressive change may be resisted is well captured by Pietersen (2002) who reckons that for many people, the prospect of change produces fear, uncertainty and doubt, more so if it is top-down and induced by the management. But even more vital to the proposed study is how such fears and uncertainties may affect the performance of the ongoing change at the company. Such confrontations have been well documented from many Asian countries. Here in Kenya, numerous accounts of illegal connections of electricity and other public utility such as water in urban slums have been

witnessed and Service providers of the affected services have been forced to seek the services of security in disconnecting these services (Estache et al (2000).

Despite the benefits enumerated by the power provider in convincing consumers in accepting the new policy, paradoxically, anecdotal evidence points to the fact that, majority of consumers have contrary opinion regarding the usage of prepaid meters. For example, consumers complain about having to spend more on electricity after being moved to the prepaid meter. Similarly, consumers in compound houses which share meters complain about having to spend more which to them is unusual than those in single household. Though the aim of every utility provider is to provide efficient service to its clients, in developing countries low-income levels continue to pose a daunting challenge especially in terms of cost recovery (Sualihu and Rahman, 2014).

Bill payment and collection efficiency also referred to as “headline efficiency” which supports adequate service provision (Kayaga et al. 2004) are generally poor; thus below 50% cost of production in Africa. These inefficiencies in billing and revenue collection are mostly due to incidence of undercharging and overcharging, due to billing errors, creating dissatisfaction among consumers, inefficiencies in the billing system, failure to establish customer base, irregular bill delivery resulting in non-payment by registered clients (Chipofya et al., 2009). The best way to avoid any form of error is to eliminate too much of human handling of the metering system. Misra and Kingdom (2012) contend that meter reading and billing errors, whether involuntary or resulting from fraudulent practices, should be eliminated by limiting the human handling of data through the adoption of efficient billing systems.

## **2.9 Effect of prepayment meter usage on customer satisfaction**

Being effective and accountable largely depends on knowing and giving account for the quantity of energy that the service providers are able to produce and distribute to the consumers. But in

most cases this has not been accounted for. And this occurs as a result of major technical inefficiencies at the various generation units and its transmission lines to the distribution unit where a substantial amount of credits have been wasted. There is another huge percentage loss to other inefficiencies other than technical and this is basically at the customer level, which include customer's deliberate attempt to temper with the metering system coupled with illegal connection so as to adjust the effective working of the meter. Meanwhile, there are various systems and mechanisms put in place to address these challenges, and this include the institution of legal penalties to the culprit, giving out the reading and billing of the meters to independent but competent bodies to oversee the billing and collection of revenue to the ECG.

But as it is known in life, nothing seems to be 100 percent correct or successful in life as far as human institutions are concern. Hence the very approach that seems to be effective and conducive for both the customers and the management with cost efficient is the use of the prepaid metering system (Power Division, 2011). Meanwhile the argument favoring the prepaid metering is that it has the potency to drastically reduce the losses incur to both the account receivables and other technical problems which are basically of human concern. Therefore, the prepaid metering system has in one way solved even if not all the problem of financial drain that the power companies, especially the ECG usually encountered (Power Division, 2011).

Nevertheless, there are two main types of cost that consumers that switch from the traditional postpaid to the new prepaid system normally encountered, one of them is the financial cost, while the other is the habitual differences that comes as a result of changing from the former to the later of energy consumption which occur prior to consumption. Meanwhile, the direct financial effect the consumer can largely experience is automatically the cost of the new prepaid

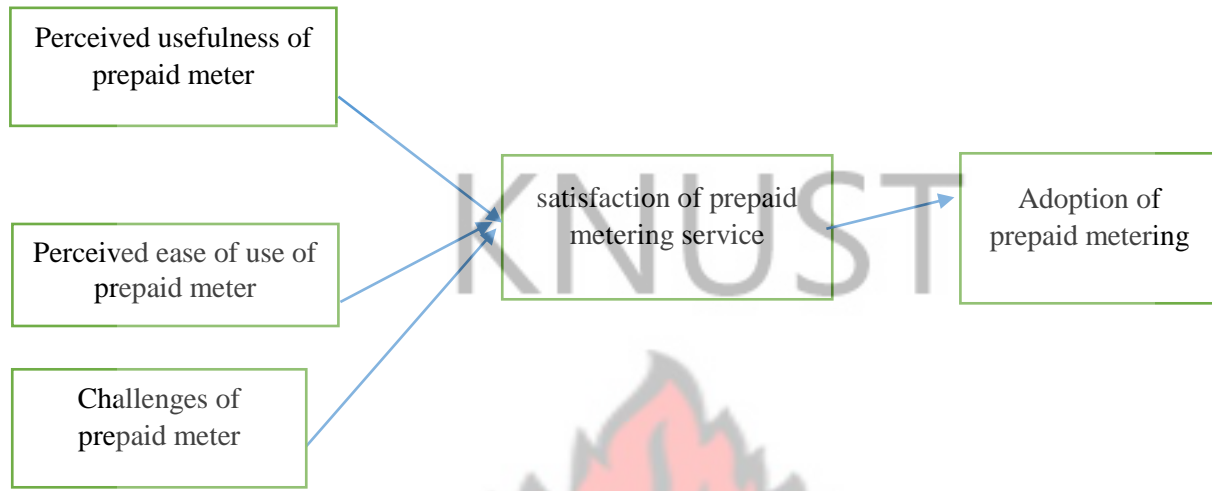
meter coupled with its associated opportunity cost which was put into consideration in relation to the financial position of the customer (Eskom, 2010).

### **2.10 Conceptual framework**

The frequent change in consumers purchase of electricity credit means that the consumers attitude and habit has drastically change either as result in increase in income level or the preference for the prepaid meter. The rate at which the costs incur or increase largely depends on the number of times the consumer recharges their credit within the month as this will also be similar to the cost incur when on the old postpaid meter system and this will largely depend on the financial capacity of the consumers. Hence on the average, the use of the prepaid meter has contributed immensely to the utility providers by reducing the financial and administrative cost and lapses which in other hand will bring the cost of selling electricity to the consumers to its barest minimum, hence there is comfort ability derived on both the utility provider and the consumer of the utility (Ariel and Luciana, 2008).

Meanwhile, the utility providers for a very long time have been aware of the potential benefit of using the prepaid meter over the postpaid meter, but this was only within the mid-1990s and this was due to the frequent development of technologies to prove that indeed the merit of using prepaid meter far out weight the post credit metering system (Ariel .et al 2008). Over the years, effort is in place to improve the affordability of the prepayment meters and strategies are also far advance in reducing cost and other associated inefficiencies which may in one way or the other affect the quality of service delivery or reducing the demand of other potential customers who may be willing to switch to the use of prepaid meters (Gómez-Lobo and Contreras, 2004).

### 2.10.1 Conceptual framework



**Figure 1: Conceptual framework**  
**Source: Author's concept**



## CHAPTER THREE

### RESEARCH METHODOLOGY

#### **3.1 Introduction**

This chapter presents the steps that were used in conducting the research. The chapter discusses the research design and approach, the target population, sample size and sample selection technique and data analysis procedures.

#### **3.2 Research design**

The study adopted Observational research design. Observational research design is a type of non-experimental research in which a researcher observes ongoing behavior. There are a variety of types of observational research, each of which has both strengths and weaknesses. Observational research design, is a social research technique that involves the direct observation of phenomena in their natural setting (Atlas, 2017). This differentiates it from experimental research in which a quasi-artificial environment is created to control for spurious factors, and where at least one of the variables is manipulated as part of the experiment. It is typically divided into naturalistic (or “nonparticipant”) observation, and participant observation. Cases studies and archival research are special types of observational research (Atlas, 2017). Naturalistic (or nonparticipant) observation has no intervention by a researcher. It is simply studying behaviors that occur naturally in natural contexts, unlike the artificial environment of a controlled laboratory setting. Importantly, in naturalistic observation, there is no attempt to manipulate variables. It permits measuring what behavior is really like. However, its typical limitations consist in its incapability exploring the actual causes of behaviors, and the impossibility to determine if a given observation is truly representative of what normally occurs (Atlas, 2017).

### **3.3 Research approach**

The study employed quantitative approach. A quantitative approach uses numerical approach in its analysis and decision making. Using quantitative approaches, the study examines the perceived usefulness of prepaid metering system in Ghana, determines the perceived ease of use of prepaid metering system in Ghana and identify the challenges confronting the success of prepaid metering system usage in Ghana. The quantitative approach was adopted based on its convenience, simplicity and reliability in explaining the variables.

### **3.4 Population and sample size determination**

A population refers to the total number of all units of the issue or phenomenon to be investigated into which all the possible observations of the same kind are made (Kumekpor, 2002). The research population consisted customers who use pre-payment meters within the Ejisu District. The population of the study is estimated about 963 customers who use prepaid metering system within the Ejisu District.

### **3.5 Sample size and sampling technique**

A sample is a portion of the population selected for analysis of the whole population. A sample of 51 respondents was selected for the study. Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population (Webster, 1985). The study adopted purposive and convenience sampling technique to customers who use pre-payment meter within the Ejisu district. Purposive sampling enabled the researcher to use judgment to select cases that will best answer the research question(s) and to meet the objectives. This form of sample is often used when working with very small samples such as in a case study research

and when the researcher wishes to select cases that are particularly informative (Neuman 2005). This technique was adopted because the researcher was interested in respondents who had knowledge about the study area. Again, in selecting customers for the survey, a convenient sampling technique was applied. Convenience sampling (judgmental sampling) involves selecting haphazardly those respondents that are easiest to obtain for the sample, as the sample selection process is continued until the required sample size has been reached (Saunders et al 2009). The researcher adopted these methods in selecting respondents that could give the right data for the particular studies.

### **3.7 Data collection source**

Data collection source for the study was mainly primary source. Primary data for the study was collected through questionnaire which was the main source of data while other information were collected from ECG' archives, books, and documentation on customers and management.

#### **3.7.1 Data collection instrument**

The data collection instrument for the study was questionnaire. The questionnaire was designed in order to facilitate the achievement of the research objectives. A draft questionnaire was presented to the thesis supervisor so that any shortcoming or weakness in the questionnaire was corrected before the final version administered. It was designed to solicit the expert opinions of customers who are primarily concerned about the study area. Lastly, the questionnaire was designed in order to enable the researcher accomplish the research objectives. The information that was needed but could not be obtained from secondary source was translated into a set of questions. In order to improve the response rate and ensure that respondents felt very

comfortable when answering the questions, the questionnaire did not require respondents to reveal their identity.

### **3.8 Data analysis procedure**

Data was analyzed using SPSS 21.0 version and Microsoft Office Excel 2010 to obtain graphs, tables and descriptive statistics to analyze the responses of respondents. Deducing from the descriptive statistics, the higher the value of the mean, the higher the disagreement with the statement: The key is as follows: One = Strongly agree, Two = Agree, Three = Neutral, Four = Disagree, Five = Strongly disagree. Furthermore, descriptive statistics, was adopted in order to enable the researcher accomplish the research objectives. A cross sectional primary data was the main data for analysis.

### **Profile of Ejisu-Juaben Municipality**

Ejisu Municipal is one of the 43 administrative and political Metropolitan, Municipal and Districts in the Ashanti Region of Ghana. The Municipal is known globally for its rich cultural heritage and tourists attractions notably the booming kente weaving industry. The Municipal stretches over an area of 637.2 km<sup>2</sup> constituting about 10% of the entire Ashanti Region and with **Ejisu** as its capital. Currently it has four urban settlements namely, Ejisu, Besease and Bonwire. The Municipality is located in the central part of the Ashanti Region and provides enormous opportunity for creating an inland port for Ghana to serve northern section of the country. It lies within Latitude 1° 15' N and 1 ° 45' N and Longitude 6° 15'W and 7° 00'W. Ejisu Municipal shares boundaries with six (6) other Districts in the Region. To the north east and north west of the Municipal are Sekyere East and Kwabre East Districts respectively, to the south are Bosomtwe and Asante-Akim South Districts, to the east is the Asante-Akim North Municipal and to the west is the Kumasi Metropolitan. The Municipality is located within

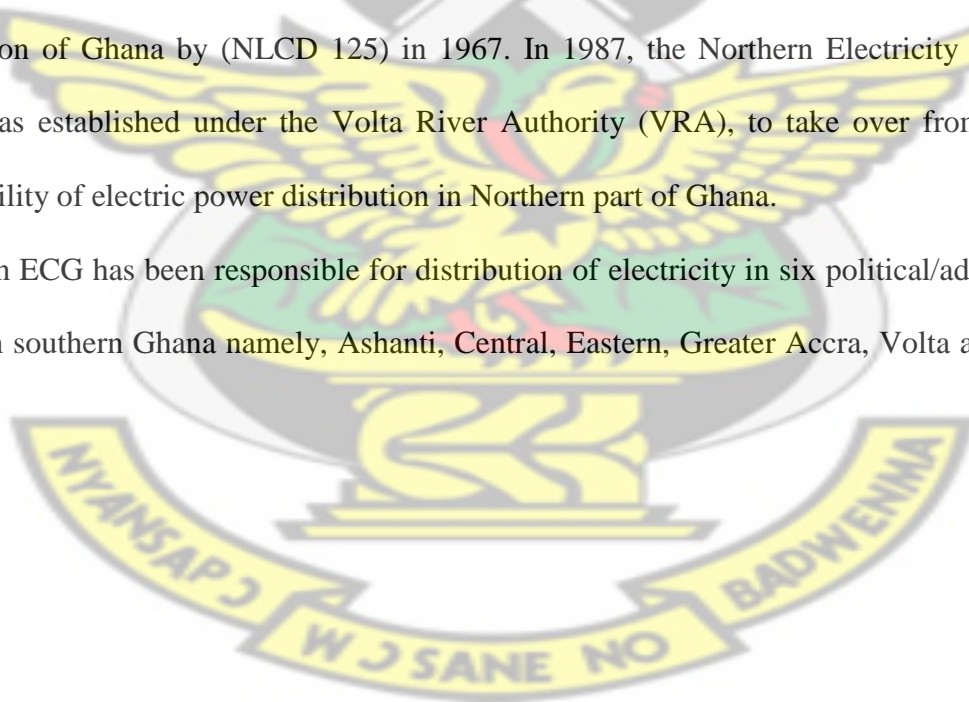
longitudes 1°5'W and 1°39' W and latitudes 7°9' N and 7°36'N. It has a large land size of about 1,782.2sq.km. (690.781sq. miles) and is the fifth largest district in Ashanti region's 30 districts. The population of the Municipality according to the 2010 Population and Housing Census stands at 143,762 with 68,648 males 75,114 females (GhanaDistricts, 2018)

KNUST

### **3.9 Profile of Electricity Company of Ghana (ECG)**

The Electricity Company of Ghana is a limited liability Company wholly owned by the Government of Ghana. The Electricity Company of Ghana Limited (ECG) was incorporated under the Companies Code, 1963 (Act 179) in February 1997. It began as the Electricity Department on 1st April 1947 responsible for distribution power in the entire country and later became the Electricity Division in 1962. It was subsequently converted into the Electricity Corporation of Ghana by (NLCD 125) in 1967. In 1987, the Northern Electricity Department (NED) was established under the Volta River Authority (VRA), to take over from ECG, the responsibility of electric power distribution in Northern part of Ghana.

Since then ECG has been responsible for distribution of electricity in six political/administrative regions in southern Ghana namely, Ashanti, Central, Eastern, Greater Accra, Volta and Western Region.



## **THE PROVISION OF ELECTRICITY BEFORE THE BUILDING OF THE VOLTA DAM AT AKOSOMBO**

The first government-sponsored public electricity supply in the country commenced in the year 1914 at Sekondi. It was operated by the Railway Administration which extended supply to Takoradi in 1928.

Meanwhile, the Public Works Department had commenced a limited Direct Current (DC) supply in Accra during the year 1922, this was immediately followed by a large Alternating Current (AC) project which commenced on 1st November, 1924.

A small plant consisting of three horizontal single cylinder oil-powered engines was installed in Koforidua in 1925 and opened by the Honorable William Omsby-Gore on 1st April 1926. Also in 1926, work commenced on the task of providing electric lighting and power to Kumasi. A restricted evening supply commenced in May 1927, and a power station was brought into full operation on 1st October 1927.

In the same year DC supply was installed at Winneba but this was subsequently changed to AC by extending an existing supply from Swedru. During the period 1929-30, a limited electricity supply was extended to Tamale until a new AC plant was installed in 1938.

The next power station to be established was Cape Coast which came into being in 1932. Subsequent to its takeover by the Electricity Department from the Public Works and Railways on 1st April, 1947. A power station at Swedru was commissioned in 1948.

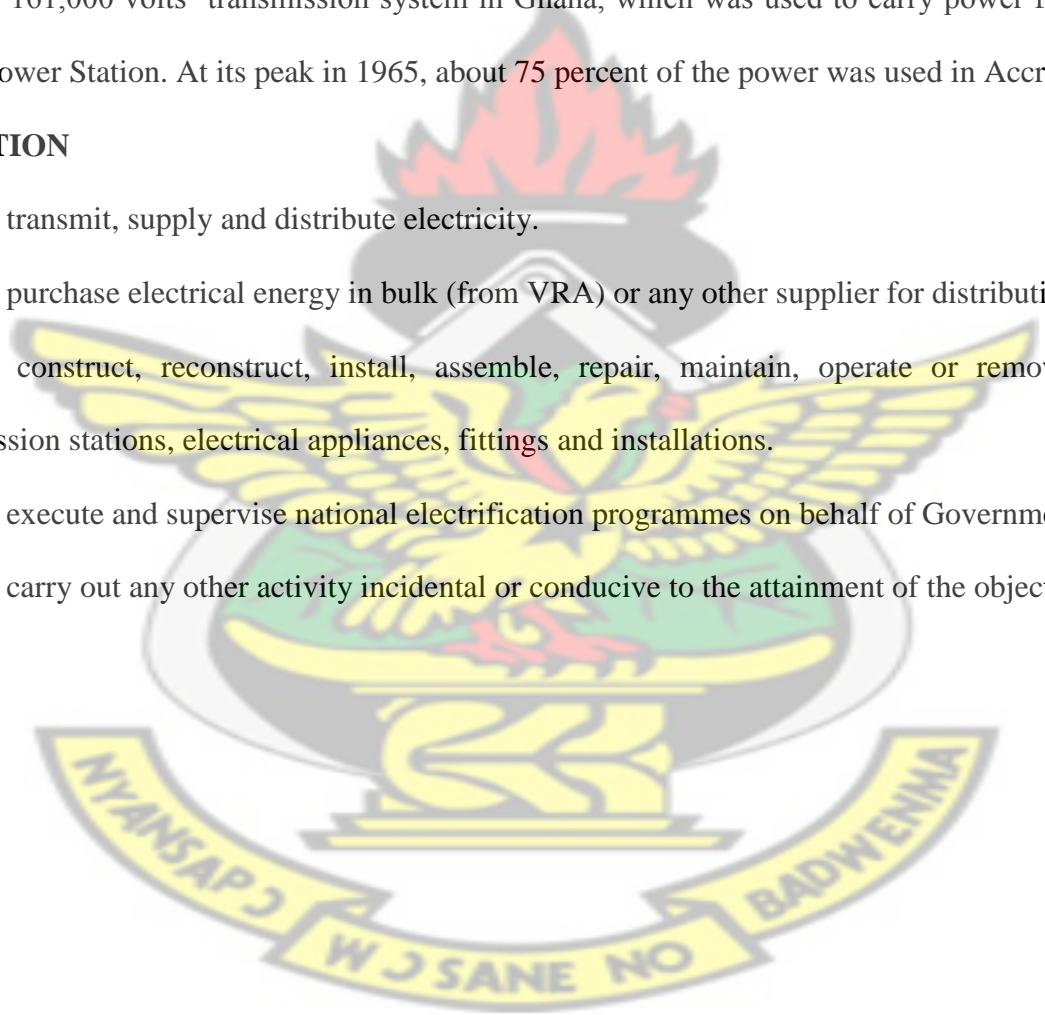
This was followed by the installation of generating plants at Oda, Dunkwa and Bolgatanga in 1948. On 27th May, 1949, an electricity supply was made available at Nsawam through the building of an 11000-volt overhead transmission line from Accra. The Keta supply which was

included in the programme was delayed by staff difficulties and was not commissioned until 1955.

The Tema power station was commissioned in 1956 with a 3x650 kW generating set. The Ho power station followed in 1957. From 1961-64. The Tema Station was extended to a maximum capacity of 35,298 kW, thus, making it probably the biggest single diesel-powered generating station in Africa. It is also on record that in 1963 the Electricity Division brought into operation the first 161,000 volts' transmission system in Ghana, which was used to carry power from the Tema Power Station. At its peak in 1965, about 75 percent of the power was used in Accra.

### **FUNCTION**

1. To transmit, supply and distribute electricity.
2. To purchase electrical energy in bulk (from VRA) or any other supplier for distribution.
3. To construct, reconstruct, install, assemble, repair, maintain, operate or remove sub-transmission stations, electrical appliances, fittings and installations.
4. To execute and supervise national electrification programmes on behalf of Government.
5. To carry out any other activity incidental or conducive to the attainment of the objectives



## CHAPTER FOUR

### DATA ANALYSIS AND DISCUSSION OF FINDINGS

#### 4.0 Introduction

This section presents the analyses of data in relation to the perception of customers in the usage of prepaid metering system in Ghana. Using Statistical Package for Social Sciences (SPSS) statistical tool, the results of the data analysis are represented in tables and graphs. Fifty-one (51) questionnaires were administered to the respondents and retrieved after a week of administering. The questionnaire can be found in the Appendix of this study.

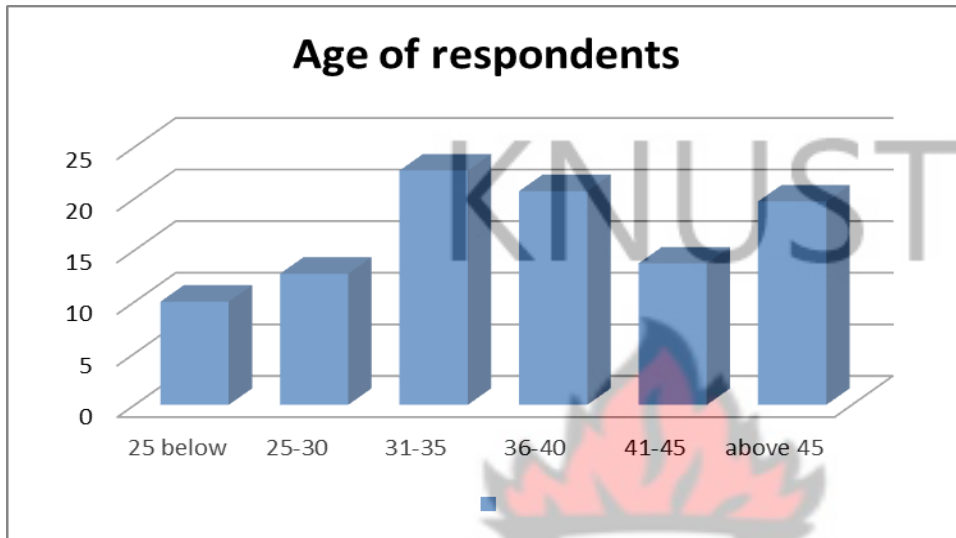
#### 4.1 Background information on respondents

This section presents the background information of respondents. The background information discussed includes age, gender, number of years of respondents' experience with prepaid metering of ECG and educational qualification of respondents. The background information was very ideal in assisting the researcher identify the characteristics of the respondents that constitute the sample under study in order to make valid inferences for effective conclusion. The results are represented in graphs below:

##### 4.1.1 Age of respondent

According to Figure 1 below, 24.8% of the respondents had their ages between 31-40 years. Additionally, 10% had their ages below 25 years constituting the least in the age distribution. The most dominant age of respondents was those with their age between 31-35 years indicating that, the study's target group of respondents who were expert in the study area were the youth. The next dominant age group in the age distribution was between 36-40 years representing

22.8% of the respondents. This indicates that respondents were matured in their delivery in their responses on the usage of prepaid metering.

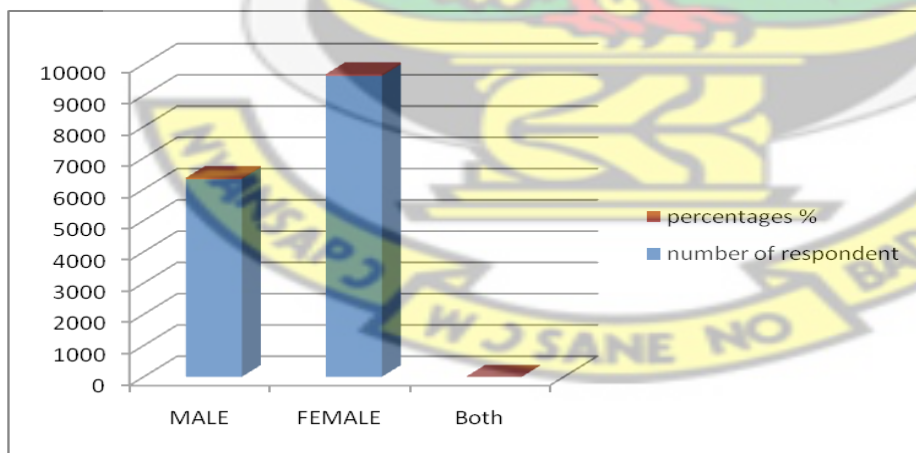


**Figure 4.1.1: Age of respondent**

Source: Field data, 2018

#### 4.1.2 Gender of respondent

Figure 4.1 below shows that 60.3% of the respondents are female with males covering about 39.7% of the respondents. Thus the study's respondents were female dominated.

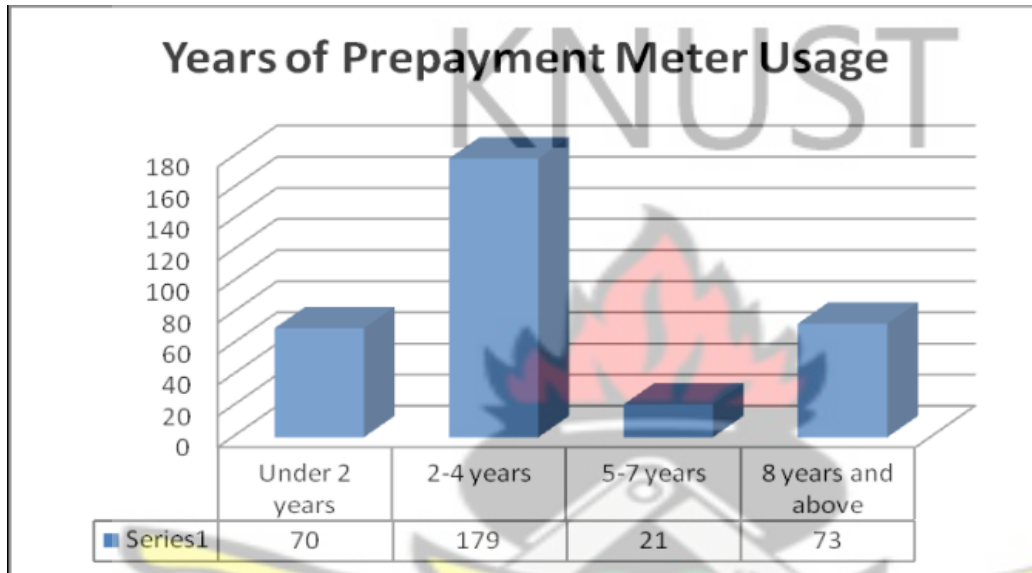


**Figure 4.1.2: Gender of respondent**

Source: Field data, 2018

### 4.1.3 Number of years of respondents work experience with prepaid metering

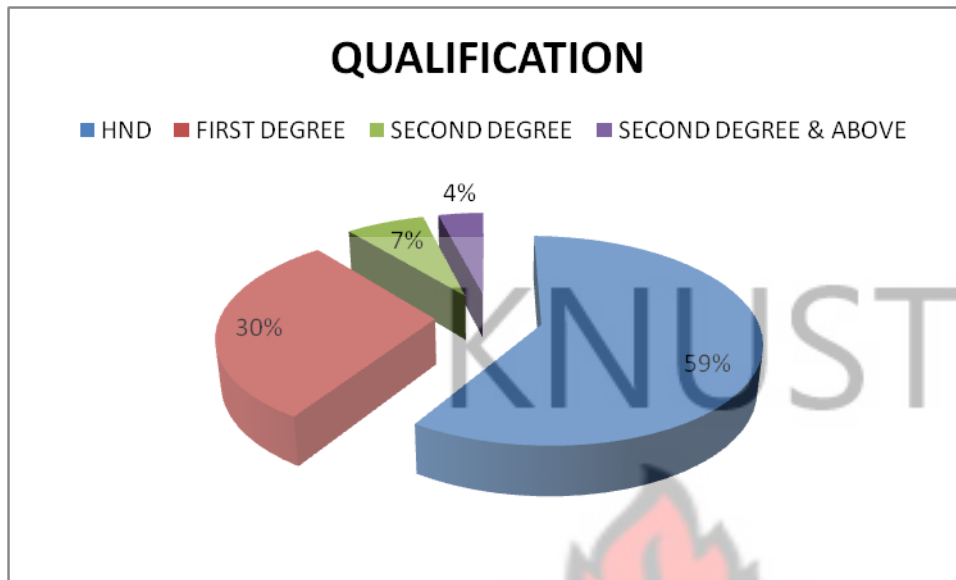
In view of Figure 4.3 below, the result indicates that, respondents who had 2-4 years' experience with prepaid metering formed about 52.2% of the total while those above 5 years' experience was about 6%. This indicates that respondents have an experience with prepaid metering system.



**Figure 4.1.3** Number of years of respondents' experience with prepaid metering usage  
Source: Field data, 2018

### 4.1.4 Educational background of respondent

The educational background of the respondent represented in figure 4 above indicates that 59% of the respondents are higher national diploma (HND) leavers with first degree following with 30% of the respondent. The least in this category are those with second degree and above. This group covers only 4% of the respondent. The dominant nature of HND leavers reveals the target market of the company's staff. The outcome also indicates that the respondents were educated enough to distinguish between various forms of electricity metering.



**Figure 4.1.4 Educational background of respondent**

Source: Field data, 2018

#### 4.2: Analysis of Perceived usefulness of prepaid metering system in Ghana.

The crucial aim of every policy introduced by firms is to contribute significant benefit to the consumer. The introduction of pre-payment meters therefore contributes significant benefit of pre-payment meter to the consumer and ECG as a whole. Table 4.2 below shows variables measuring importance of pre-payment meter usage.

**Table 4.1: Descriptive statistics on the perceived usefulness of prepaid metering system**

Perceived usefulness variables	Mean	Std. Deviation	% of respondents	Number of respondents
I am now careful with my consumption of electricity	4.04	1.160	80.8%	41
I pay less since I shifted to the prepaid billing system	3.31	1.289	66.2%	33
I buy credit at my own convenience and do not fear disconnection	3.95	1.196	79.0%	40

I don't pay any money when I don't use the meter	3.45	1.267	69.0%	35
No more disappointment when one is uncertain how much to pay when post meters are use	3.62	.956	72.4%	37
There is no disconnection since I started using prepayment meter	3.86	1.013	77.2%	39
No need to pay re-connection fee	4.08	.776	81.6%	41
<i>Cronbach alpha</i>			0.69	

**Source:** Researcher's field work, 2018

#### **Interpretation of results according to Table 4.1 ( $\alpha=0.69$ )**

**Careful with energy consumption:** With regards to ascertain the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District of ECG in Ejisu-Juaben Municipality, a mean of 4.04 of the respondents with a total percentage rate of 80.8% attest to the fact that with the introduction of prepaid meter, consumers are now careful with the consumption of electricity and have taken energy conservation practices seriously. This is because most of the respondents argued that they find it difficult to buy credit frequently hence there is the need to carefully conserve and manage the credits purchased. It pays to save any money that comes your way and one major way of wasting money is through mismanagement. But the remaining 19.2% of the respondents disagreed that even still with the prepaid system, consumers still waste credits and are not careful with energy consumption.

**Pay less:** The survey was further conducted on finding the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District of ECG in the Ejisu Juaben Municipality. A mean of 3.31 of the respondents with the percentage of 66.2% is of the view that with the introduction of the prepaid system, their bill or payment has reduced drastically.

Reasons assigned to this are that consumers begin to manage the credit purchased effectively devoid of waste and the necessary energy conservation tips have been adhered to. And again, since majority of the respondents are using separate prepaid meters, it has helped them substantially to reduce the energy consumption hence effectively leading to less expenses on energy consumption. Meanwhile, the remaining 33.8% of the respondents still hold the view that they still spend much on energy usage, especially the prepaid meter system.

**No fear of disconnection:** Again, the survey to ascertain the relevance of prepaid metering system over the post-paid system in the Ejisu District revealed that a mean of 3.95 of the respondents with a percentage rate of 79.0% is of the view that they buy credit at their own convenience and do not fear any disconnection. This was due to the fact that in prepaid metering system, the consumer is independent and responsible for the purchase of their own credit as and when it pleases them, hence there is no fear of disconnection for non-payment of bills. And again, the consumer can conveniently decide as and when to use the electricity power without incurring any cost. But the remaining 21.0% of the respondents are of the view that in some cases, even with the use of prepaid, they are still depending on the main power supply from the main service or electricity provider. Moreover, the consumer can be disconnected on the basis of any illegal connection and the subsequent fear of been jailed.

**No cost incurs:** Again, with regards to ascertain the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District, a mean of 3.45 of the respondent with a 69.0% of the response rate in the district are of the view that they don't pay any money when they don't use the meter. Here it was conveniently clear that once consumption of the electricity did not take place there is equally no charges or payment levied on the consumer, hence the consumer has the liberty to regulate their own consumption level and can choose to put off the

meter at any time they prefer. While the remaining 31.0% of the respondents argued that in most cases, the consumers of electricity power turn to be levied by the ECG for some special charges such as strict light charges, government special levies. This has disputed the fact that consumers do not pay if no consumption or usage has taken place.

**No more disappointment:** The survey was further conducted on finding the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District, a mean of 3.62 of the respondents with a percentage of 72.4% strongly attest to the fact that there is no more disappointment when one is uncertain how much to pay when post meters are used. In this instance consumers or the respondents in the District alluded to the fact that the prepayment system has brought major relief to them from the difficulties and challenges encountered under the post-paid metering system where the consumers in most cases are not aware of the exact amount until it is finally released by the ECG officers. Since the prepaid system has given the consumers the opportunity and control over power consumption, the usual disappointment suffered under the post-paid system has been taken away. But the remaining 27.6% of the respondents still believe that the disappointment still exists since the ECG officials in most cases slap them with some charges even with the prepaid meter system. The findings are in line with a study that found that, there is the need for consumers to wholly welcome the prepayment meter system and it really ensures that consumers will only pay energy used but not the bills that are estimated and distributed to consumers at the end of every month (Ogijor and Otasowie, 2010).

**No disconnection:** With regards to ascertain the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District, a mean of 3.86 of the respondents with a total percentage rate of 77.2% testify that with the emergence of prepaid metering system, power disconnection for inability to pay electricity billon times has become things of the past. Prepaid

metering system serves as a mobile recharge system where individual consumers recharge their own credit any time they run out of credit or the recharged credits have been exhausted, the issue of whether to use electricity or not is at the discretion of the consumer, and the ECG has it as duty to provide only meters to every household including industrial users. Meanwhile, the remaining 22.8% of the respondents again argue that in a situation of any illegal connection or non-conformance of the rules and regulations governing the ECG, individual consumers can have their lines disconnected or even punish the offenders. Again the customer satisfaction can be seen from the fact that no disconnection takes place by the ECG. Customers point to the fact that *'customer determines how much power he/she needs at a time and make purchases accordingly'* and the *'customer is his/her own dis-connector and re-connector'*.

**No need for reconnection fees:** The survey was further conducted on finding the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District. A mean of 4.08 of the respondents with an overall percentage of 81.6% were convinced that there is no need to pay re-connection fee since the prepaid system allows the consumers in the District to regulate the ways and manner the electricity is being used by the customers of ECG. Individual customers or respondents in the district can decide to disconnect the power and connect it at their own convenient time without paying any disconnection fees to the service providers, again the system will automatically disconnect itself as soon as the credit on it is exhausted and it will again switch on immediately there is a new recharge. But the remaining 18.4% of the respondents hold a different view and argued that consumers will experience disconnection fees especially if the ECG officials detect some foul play from the consumers.

**Conscious with spending:** Again, with regards to ascertain the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District, a mean of 3.78 of the

respondents which constitute a percentage rate of 75.6% are now conscious with how much they spend in a month regarding the purchase of prepaid credit as compared to the post-paid meters where individual consumers are more often than not aware and will find it tedious to be aware of their level of spending. With the prepaid system the individual consumer is always aware of how much credit they purchase at a particular point in time and hence it is always easy to control too much spending on electricity.

Perhaps the most important benefit of prepayment metering to ECG is its ability to improve cash flow and hence revenue mobilization. Customers pay upfront before they use the supply and these enhance revenue for the Company. Cost Reduction is the next benefit of prepayment to ECG. In raising bills for its credit metered customers, the company incurs huge costs. These include the cost of stationery such as bill cards and other printing materials and salaries of meter reading staff and other overheads. In prepayment metering, such costs are not incurred. The responses from customers confirm findings that suggest that, numerous benefits that accrued to the providers in the form of massive cut down on revenue losses, acute curtailment on illegal connections, finally a move in conserving energy to the utility provider (Quayson Dadzie, 2012).

#### **4.3: Perceived ease of use of prepaid metering system**

The ease of use of prepaid metering system is critical as far client satisfaction with pre-payment meter usage is concerned. The ability of prepayment meters to give value to customers thereby satisfying their needs is important. Table 4.3 below shows variables measuring consumers perceived ease of use with respect to pre-payment meter usage.

**Table 4.1: Descriptive statistics on the perceived ease of use of prepaid metering system**

Perceived ease of use variables	Mean	Std. Deviation	% of respondents	Number of respondents
The prepayment meters are efficient and does not easily spoil	3.77	3.745	75.4%	38
I am satisfied with prepaid because there is no accumulated debt	3.85	1.269	77.0%	39
I am satisfied because I purchase electricity at the nearest electricity vendor	4.29	.849	85.8%	43
I am satisfied with paying upfront before using electricity	3.61	1.105	72.2%	36
I am satisfied with the quick response from ECG any time I encounter challenge	3.01	1.128	60.2%	30
I prefer prepayment meter to post payment meter	3.91	1.102	78.2%	40
It is easy to buy prepaid credit than post payment meters	3.52	1.067	70.4%	35
<i>Cronbach alpha</i>			<i>0.73</i>	

**Source:** Researcher's field work, 2018

#### **Interpretation of result according to Table 4.2 ( $\alpha = 0.73$ )**

**Efficient pre-payment meter:** With regards to ascertain customer satisfaction with respect to pre-payment meter usage within the Ejisu District, a mean of 3.77 of the respondents with a percentage rate of 75.4% are of the view and attest to the fact that the prepayment meters are efficient and does not easily spoil. Reasons assigned to this is as a result of the satisfaction consumers enjoy from the use of prepayment meters, the use of prepayment meters are very effective to the customers and are free from petty problems that confront most of them on daily

basis. Satisfying customers profitably is another major priority of ECG to their customers in the District. Meanwhile, the remaining 14.2% of the respondents in the district hold a different view and think that the standard of customer satisfaction offered by the ECG in the Ejisu District through the adoption and implementation of the prepaid metering system still needs to be given much attention.

**No accumulated debt:** The survey was further conducted on finding the customer satisfaction with respect to pre-payment meter usage within the Ejisu District. A mean of 3.85 of the respondents which constitute a percentage rate of 77.0% are of the view that they are satisfied with pre-paid because there is no accumulated debt. Paramount among the reasons given is the fact that with the pre-paid metering system, consumers can only enjoy electricity usage if they buy pre-paid credit; therefore, the issue of debts accumulation is not associated with the system. With the prepayment system, consumers themselves regulate their own energy consumption therefore it is difficult and not possible to accumulate debt. But the remaining 23.0% of the respondents hold a different view and think the system can equally incur and accumulate debt.

**Nearest vendor:** With regards to ascertain customer satisfaction with respect to pre-payment meter usage within the Ejisu District, a mean of 4.29 of the respondents with a percentage rate of 85.8% are convinced that they are satisfied because they purchase electricity at the nearest electricity vendor. This is truly ascertained because with the emergence of the prepaid system, a large number of vendors, customer service point and sales point are wide spread all over to help the consumers to easily access the credit at any time thereby the increasing in the satisfaction level of the consumers. ECG through its customer satisfaction motive has established customer care system to effectively address customer complaints thereby ensuring customer satisfaction. But the remaining 23% of the respondents also argue that even though there are sales points all

over every community for consumers to access, there is the problem of lateness and laziness on the part of the sales representatives and other workers who seek the welfare of the consumers. The finding confirms a study that suggests that, issues pertaining to how regulations of the system should be carried out, aimed at motivating and encouraging ready access and making the credit available to consumers so that they can effect payment for the services enjoyed (Casarin and Nicollier, 2009).

**Upfront payment:** Concerning the issue of customer satisfaction with respect to pre-payment meter usage within the Ejisu District, a mean of 3.61 of the respondents with a percentage rate of 72.2% of response rate agreed and testified that they are satisfied with paying upfront before using electricity. This is because with the prepaid system, consumers can only enjoy the electricity usage if the credit are being purchased, hence there is an element of upfront payment which release the burden on the consumers. But the remaining 27.8% of the respondents argued strongly that they are not comfortable with the upfront payment system because it heavily places financial burden on the consumers. It was further argued that the upfront payment system largely assists only the rich in the society leaving majority of less privilege ones dissatisfied.

**Quick response:** In further assessment of customer satisfaction with respect to pre-payment meter system within the Ejisu District, a mean of 3.01 of the respondents with a percentage rate of 60.2% believed that customers are most often satisfied with the quick response from ECG any time they encountered challenges. Challenges such as disruption in power supply, fault occurrence in some part of the district, corrections of errors and mistakes in the billing system mostly receive quick response and correction from the operators anytime any of such challenges occurs. Since prepayment metering system is a new introduction or innovation, there bounds to be some few challenges, therefore systems are put in place to quickly correct any teething

problems along the line of operation. But the remaining 39.8% of the respondents disagreed and lamented that emergency response team usually turn to drag their feet and act slowly anytime customers report a problem to them.

***Prefer prepayment:*** With regards to ascertain customer satisfaction with respect to pre-payment meter usage within the Ejisu District, a mean of 3.91 of the respondents with a total percentage rate of 78.2% as a response rate, prefer pre-payment meter to post payment meter. One prominent reason assigned to this is the numerous advantages associated with the use of pre-payment meter. And among the advantages include, the elimination of frequent disconnection, consumers' privacy is relatively assured, consumers control over how to use the credit purchased and among others. Meanwhile, the remaining percentage of the respondents which constitute 21.8% of the respondents hold a different view and think that prepaid metering system also come with its acute problems and challenges, hence consumers' needs to be very careful in totally condemning the post-paid metering system.

***Easy to buy prepaid:*** Concerning the issue of customer satisfaction with respect to pre-payment meter usage within the Ejisu District, a mean of 3.52 of the respondents with a percentage rate of 70.4% truly believe that it is easy to buy pre-paid credit than post payment meters. Here there is denial of the fact that, prepaid credit is easy and simple to buy and use at any point in time as compare to the post-paid metering system where bills are distributed at the end of every month with its associated problems. These problems include delay in disbursement of bills, over billing and other technical errors usually committed by the ECG officials. Meanwhile at the same time, the remaining 29.6% of the respondents hold a different view and believe that though the prepaid credits are easy to buy, yet still the service providers in most cases play some shows some

lukewarm attitude towards the consumers, and also delay in service delivery was cited as another predicament hindering the progress of the system.

### **Analysis of the Challenges confronting the success of prepaid metering system usage**

Obstacles often characterize human endeavor and quite naturally, there are challenges that are associated with pre-payment meter usage for both customers and ECG. Table 4.3 shows the variables used to measure the variables measuring challenges confronting pre-payment meter usage.

**Table 4.3: Descriptive statistics on the challenges of prepaid metering system usage**

<b>Challenges variables</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>% of respondents</b>	<b>Number of respondents</b>
I am use to the post payment system since it not convenient using pre-paid	2.31	1.307	46.2	24
I experience more blackout since I shifted to prepaid billing system	2.40	1.429	48.0	25
Spend more money and get small unit when you purchase more than once in a month	3.42	1.451	71.0	36
We always fight over sharing of bill	3.02	1.488	68.8	35
Difficulty in pre financing as other users complain of not having money	3.05	1.404	61.0	31
Disadvantageous to the poor since without money to buy pre-paid, you cannot us electricity	3.44	1.416	60.4	30
There is less education on the use of pre-payment meter	3.55	1.325	68.4	35
<i>Cronbach alpha</i>			<i>0.71</i>	

**Source: Researcher's field work, 2018**

### **Interpretation of result according to table 4.3 ( $\alpha=0.71$ )**

*Inconvenience in pre-payment Usage:* With respect to challenges facing customers using pre-payment meters within the Ejisu District, a mean of 2.31 of the respondents which constitute a percentage rate of 46.2% attested to the fact that they prefer the post-paid meter to the new prepaid meter because they are used to it. Paramount amount the reasons given is that the post-paid meter usually allows them to enjoy electricity usage even if they do not have money to pay instantly. Again, the post-paid meter usage can minimize petty conflict and misunderstanding that might arise as a result of two or more consumers hooked to a single prepaid meter. One can also say that; consumers of electricity find the post-paid metering system to be more convenient than the prepaid because with the post-paid there will not be frequent power disruption leading to dark out whiles with prepaid, the power can go off as soon as the credit purchased is exhausted. But the remaining 53.8% of the respondents hold a different view and think that, change to the new prepayment meter is of immense benefit to them since the tendency to delay bill payment which may subsequently leads to disconnection is largely avoided under the prepaid meter system.

*Black out experiences:* Again with the issue of challenge that customers face regarding the usage of prepaid meter, a mean of 2.40 of the respondents with a percentage rate of 48.0% is of the view that they experience more black out after been shifted to the prepaid billing system. And difference reasons were attributed to this, and among these reasons include, purchasing the credit frequently is actually painful and difficult to most of the consumers. Majority of the respondents use heavy and sophisticated gadgets which consume high voltage of electricity thereby subjecting consumers or users of prepaid meter to frequent power cut off or black out. Moreover, since in most of the households in the District share the prepaid meter with their neighbors',

there is bound to be problem with the purchase of the credit, hence leaving the users of the prepaid meter to experience more blackouts anytime there is a delay in the payment and recharging of the prepaid meter cards. Meanwhile the remaining 52.0% of the respondents are of the view that instead of experiencing more and frequent blackout, the prepaid metering system rather helps in eliminating if not all to its bearers' minimize the issue of frequent power.

*Minimal Education:* The survey was further conducted on finding the challenges that consumers of electricity in the Ejisu District encountered in using the prepaid meter system, a mean of 3.55 of the respondents which constitute a percentage rate of 71.0% is of the view that there is less education on the use of prepaid meter and hence majority of the consumers of electricity find it difficult to change to the use of prepaid meter. This is because both customers and employees of the ECG at Ejisu District have it as duty bound to educate both the domestic and industrial consumers of electricity about the need to change to the prepaid metering system but it is evidently clear that this was not done. And even if it was done, it implies that it did not go down well with most of them and more needs to be done in order to intensify education on the need to adopt the prepaid meter usage. Another reason could be the laziness on the side of the people been employed to disseminate information. Meanwhile the remaining 29.0% of the respondent disagree and argue that in every human society, change is always inevitable, hence majority always prefer the old system of doing things.

*Disadvantage to the poor:* Another serious challenge that customers using prepaid in Ejisu District encountered on countless occasions was ascertained and a mean of 3.44 of the respondents with a percentage rate of 68.8% was of the view that the system is always disadvantageous to the poor since without money to purchase credit, the poor cannot enjoy electricity usage. This is because persistent and continuous use of power largely depend on the

consumers' ability to buy credit frequently in order to enjoy electricity, and in a situation where the poor in the District at a time where the available credit on the meter is exhausted and there is no money to effect a new recharge or buy the credit, then the poor is at disadvantage. Meanwhile, the other 31.2% of the respondent also argue that the system rather, will go a long way to help the poor in the society to avoid power disconnection due to pilling up of bills and its associated challenges and disgrace; hence the system will enable the poor to practice customers effectively.

*Difficult in pre financing:* The survey was further conducted on finding the challenges that consumers of electricity in the Ejisu District encountered in using the prepaid meter system, a mean of 3.05 of the respondents in the District with a total percentage of 61.0% also pointed to the fact that there are difficulties in pre financing as other users complain of not having money. In times where the consumption and purchase of the prepaid credit needs to be pre financed in order to avoid power cut or blackout, there is equally the problem of raising money to pre finance it thereby posing a serious challenge and discomfort to the consumers. And in a situation where there are two or more people on the same meter, contributing to finance the purchase of the credit usually becomes a very herculean task to the ordinary consumer. But as the case may be, 39% of the remaining respondents in the District disagree and argue that the difficulties encountered are usually as a result of customers and improper planning on the part of the consumers in the District, and last but not the least, it takes greater commitment to achieve a task.

*Fight over sharing of bills:* Again with the issue of challenges that customers face regarding the usage of prepaid meter in the Ejisu District, a mean of 3.02 of the respondents with a percentage rate of 60.4% of the respondents pointed to the fact that in most cases they always fight over

sharing of bill to members that are on one particular prepaid meter. This happens as a result of individuals' perception of cheating and discrepancies that emanate as some use more gadgets than the others and in this case, fights and quarrels are abound to occur. In a situation where frequent billing and purchase of credit become intense, misunderstanding and petty fighting will automatically ensue between these members. Again when a particular person or individual refuses to pay the amount due them, then misunderstanding will emerge leading to fighting. Customers of ECG confirm that 'customers who live in compound houses where more than one tenant use the same meter create conflicts as to how to share or apportion cost and hence leads to the dissatisfaction of customers. Whiles the remaining 39.6% of the respondents believe that fighting can only arise if maturity and integrity among the respondents are lacking, hence proper measures and mechanisms need to be put in place to quickly resolve any teething problems in order to encourage the prepaid meter usage.

*More money with less credit:* The survey was further conducted on finding the challenges that consumers of electricity in the Ejisu District encountered in using the prepaid meter system, a mean of 3.42 of the respondents which constitute a total percentage rate of 68.4% has ascertained that consumers of electricity power spend more money and get small unit when you purchase more than once in a month and thereby creating discomfort and irritation among the consumers in the District. This is very difficult to avoid because, no matter how well consumers manage their consumption and electricity usage it is likely that the credit will be exhausted before the end of every one month. Once it is only advisable to buy prepaid credit once a month, consumers tend to pay more for less credit. The other 31.6% of the respondents are of the view that it will be prudent for every individual to practice energy conservation in order to avoid wastage of power.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

#### 5.0 Introduction

In this chapter, the study explored the summary of findings, recommendations that are stated based on the study and conclusion of the study. The summary of findings is captured under the objectives which are stated below.

#### 5.1 Summary of findings

##### 5.1.1 Perceived usefulness of prepaid metering system in Ghana

In accessing the relevance of prepayment meter usage over the post-payment meter usage within the Ejisu District, findings revealed that, with the introduction of prepaid meter, consumers are now careful with the consumption of electricity and have taken energy conservation practices seriously. Customers are of the view that with the introduction of the prepaid system, their bill or payment has reduced drastically; customers again buy credits at their own convenience and do not fear any disconnection. The customers in the District are of the view that they don't pay any money when they don't use the meter. Moreover, customers in the District strongly attest to the fact that there no more disappointment when one is uncertain how much to pay when post meters are use. And with the emergence of pre-payment metering system, majority of the respondents testify that power disconnection for inability to pay electricity bill on time has become things of the past. And last but not the least, customers get convince that there is no need to pay re-connection fee since the prepaid system has allow the consumers in the metropolis to regulate the ways and manner the electricity has been used by the customers to ECG.

### **5.1.2 Perceived ease of use with respect to pre-payment meter usage**

With perceived ease of use with respect to prepayment meter usage, findings revealed that, customers are of the view and attest to the fact that the prepayment meters are efficient and does not easily spoil, and that customers are satisfied with pre-paid because there is no accumulated debt. Another level of satisfaction derived with respect to the prepayment meter usage is that customers in the District are convinced that they are satisfied because they purchase electricity at the nearest electricity vendor; customers in the district duly testify that they get the maximum satisfaction with respect to paying upfront before using electricity. Whiles some cross section of respondents in the District are of the view that customers are most often satisfied with the quick response from ECG any time challenges are encountered.

### **5.1.3 Challenges confronting the success of prepaid metering system usage in Ghana**

In evaluating the challenges that confront customers using pre-payment meters within the Ejisu District, cost of changing to pre-payment meter confronts management of ECG. In order to change from credit (postpaid) to prepaid meters, the company has to incur a lot of cost. Again the finding revealed that the system is truly disadvantageous and cannot in all materials times benefit the poor in the District, that consumers of electricity power spend more money and get small unit when you purchase more than once in a month and thereby creating discomfort and irritation among the consumers in the District, difficulties in pre financing as other users complain of not having money, less education on the use of prepaid meter and hence majority of the consumers of electricity find it difficult to change to the use of prepaid meter, customers again experience more black out after been shifted to the prepaid billing system.

## **5.2 Conclusion**

The result generally implies that ECG both the management and authorities at Ejisu have placed customer satisfaction first and deem it as its core mandate to satisfy customers effectively as a result of prepayment metering system and its usage in the district. The research clearly indicated that customers in the District have whole heartedly embraced the emergence of the prepayment metering system in the and the management's readiness to effectively address any teething problems and challenges confronting the customers in the District. Aside the numerous challenges confronting customers with respect to adoption of pre-payment meter, there should be more effort and strategies on the part of ECG to increase client satisfaction and customers as well should endeavor to abide by the rules and regulation pertaining to pre-payment meter usage.

## **5.3 Recommendations**

The following recommendations are worth considering based on the study.

The units must be converted to cash in order to know exactly how much they spend in the month for electricity consumption. This will enable consumers in the District to calculate in monetary terms the amount spent on energy usage, and its effect on how well the customers in the District have access and welcome the prepaid metering system.

It is recommended that more or additional prepaid meters should be given to every customer, including households and industrial usage. Its significant or resultant effect is increase in revenue mobilization as the problem of illegal connection and refusal to pay electricity bill under the post-paid system has become things of the past.

Furthermore, the prepayment meters should be handled with care by the service providers especially during fixing and installation of the prepayment meters in order to prevent the meters

from developing fault. This is because any little fault developed can equally lead to errors in energy consumption thereby creating inefficiency and discomfort to the customers in the District. Prepayment meters are good and laudable as it solves the problem of inconveniences customers usually experience especially disconnection and reconnection fees, hence it is therefore recommended that the tariff should be reduced as consumers pay in advance under the prepayment system.

There should be system or monitoring team well trained and established to check and resolve any discrepancies that may arise and also to check any illegal connections that may derail ECG from effective revenue mobilization.

Another prominent recommendation is for ECG to provide every household or individuals with separate meters more especially to the compound houses to do away with misunderstanding and petty squabbles in purchasing unit.

Cost reduction and energy conservation is crucial for the sustainability of the energy sector, hence it is strongly recommended that, the service providers especially ECG should engage in phasing out all the post-paid meters and replace them with the prepaid in order to save a substantial amount of energy.

It is further recommended that more education on the use of prepaid metering should be intensified so as to inform customers about the need for them to switch to the prepaid metering system and this should be done diligently in order to avoid any misinformation and its subsequent effect on consumer's perception.

### 5.3.1 Areas for further study

The study relies solely on quantitative data and the findings are based specifically on cross-sectional research design, thus, ignoring qualitative data and longitudinal survey design. Future research may adopt use of qualitative data and data collected through longitudinal study design. In addition, other urban district excluded population may be used as samples in future studies.



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## APPENDIX

### QUESTIONNAIRES

This questionnaire seeks to collect data on “*Assessment of Prepaid Metering System in Ghana: Consumer perception analysis*”. The data collected will be used for academic purpose only and confidentiality is assured. Please answer the question by ticking the appropriate boxes or providing your answers where necessary. Thank you

**Researcher Name:**

**TO BE COMPLETED BY CUSTOMERS OF USING PREPAYMENT METER**

**Demography of Respondent**

1. **Gender:** Male  Female

2. **Age**

Under 20 years  21-30 years  31-40 years  41-50 years  51years and above

3. **Marital status:** Single  Married  Divorced

4. **Highest Educational Level:** PhD  Masters Degree  First Degree  HND  SSCE/MSLC/Basic  No formal Education

5. **How long have you been using prepayment meter**

Under 2 years  2-4 years  5-7 years  8 years and above

6. **Where are you using the prepayment meter?**

Domestic  Industrial  Both

7. **Are you using the pre payment meter alone? Yes  No**

#### **Section 2: Assessing the perceived usefulness of prepaid metering system**

From the statement below, please indicate your level of agreement or disagreement to the following statements. Please use the scale below

**1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree**

<b>Perceived usefulness variables</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I am now careful with my consumption of electricity					
I pay less since I shifted to the prepaid billing system					
I buy credit at my own convenience and do not fear disconnection					
I don't pay any money when I don't use the meter					
No more disappointment when one is uncertain how much to pay when post meters are use					
There is no disconnection since I started using prepayment meter					
No need to pay re-connection fee					

**Section 3: Perceived ease of use of prepaid metering system**

From the statement below, please indicate your level of agreement or disagreement to the following statements. Please use the scale below

<b>Perceived ease of use variables</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
The prepayment meters are efficient and does not easily spoil					
I am satisfied with pre-paid because there is no accumulated debt					
I am satisfied because I purchase electricity at the nearest electricity vendor					
I am satisfied with paying upfront before using electricity					
I am satisfied with the quick response from ECG any time I encounter challenge					
I prefer pre payment meter to post payment meter					
It is easy to buy pre paid credit than post payment meters					

**Section 4: Assessing the challenges of prepaid metering system usage**

From the statement below, please indicate your level of agreement or disagreement to the following statements. Please use the scale below

<b>Challenges variables</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I am use to the post payment system since it not convenient using pre paid					
I experience more blackout since I shifted to prepaid					

billing system					
Spend more money and get small unit when you purchase more than once in a month					
We always fight over sharing of bill					
Difficulty in pre financing as other users complain of not having money					
Disadvantageous to the poor since without money to buy pre-paid, you cannot use electricity					
There is less education on the use of pre-payment meter					

