

# Effects of Perceived Billing System on Customers' Preference for Pre-Paid Electricity Metering System in Ekiti State, Nigeria

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**Abstract**— *This study examined how customers' preferences for pre-paid power metering systems in Ekiti State, Nigeria, were influenced by their perceptions of the billing system. Primary method of data collection was used. Data were obtained via a structured questionnaire that was given to a carefully chosen sample of 381 electricity users in the Ado-Ekiti metropolitan, the state capital of Ekiti, using a systematic sampling technique. The extent to which customers' preferences are impacted by how they perceive the billing system was examined using the Pearson product moment correlation method. The findings showed that customers' preferences for pre-paid power metering systems are positively and significantly influenced by how they view the billing system. The findings showed that customers' preferences for pre-paid power metering systems are positively and significantly influenced by how they view the billing system.*

**Keywords**— *Electricity Metering System, Billing System, Pre-paid metering, Customers' Preference.*

## I. INTRODUCTION

In the past, electricity was seen as a public utility in the Nigeria society, hence, considered a free gift from government. Its generation, transmission and distribution were the sole responsibilities of the Federal Government with little complements from state and local governments; whereas, citizens consider it a social amenities and part of the feedback from the payment of their taxes. In this wise, it was so unusual for the then electricity supplying organisation (the defunct Electricity Corporation of Nigeria (ECN), (1950-1972), National Electric Power Authority (NEPA), (1972-2005)) to bill their customers for payments, and even, if customers were billed at all, there were no embarrassingly aggressive pursuits by the Authority in collecting the bills from the customers despite the relative stability of the supply during the period

compared to the present days. In all spheres of human endeavor administrative, industrial, commercial, and residential electricity has grown increasingly prevalent throughout the years (Azodo, 2014).

The list of established sectors where the use of electricity has become standard practise includes everything from residences, social services, industry, education, and agriculture to defence and, of course, transportation in some countries (Olokoba, Ibrahim & Abdulraheem-Mustapha, 2010). After air and water, energy supply has taken the place of importance as a vital component of life (Abayomi, 2012). Numerous research found in the literature support the idea that one of the most crucial requirements for sustaining life is electricity (Azodo & Adejuyigbe, 2013; Isola, 2007; Makoju, 2002). Cooking, refrigeration, washing, ironing, lighting, entertainment, air

conditioning, and water pumping are just a few of the household chores that require electricity (Ekpo, Chuku, & Effiong, 2011).

Despite this, Nigeria's power system is characterised by irregular behaviour, frequent interruptions, total blackouts, an inadequate and epileptic supply of electricity, etc. Nigeria experiences power disruptions for roughly 26 days every month. The eight-hour daily power interruptions that Nigeria experiences are significantly worse than the regional and global average records (Moyo, 2012). Yet, customers are still being forced to pay for the poor service quality through arbitrary billing system (Azodo, 2014).

However, with the poor performance of the sector, over a decade ago, the Federal government of Nigeria, considering the sector as not being effectively managed and the inability of NEPA to cope with the modern challenges thereby recommended it for privatization. To achieve this, the Bureau of Public Enterprises (BPE) was tasked with the responsibility. This brought about the handing over of the sector to an Initial Holding Company (IHC) known as Power Holding Company of Nigeria (PHCN) Plc on 31<sup>st</sup> May, 2005 and its subsequent unbundling of the sector into 18 successor companies as a result of Electricity Power Sector Reform (EPSR) Act signed into law by former President Olusegun Obasanjo on March 11, 2005. Despite the privatization of power sector, there were still cases of poor service delivery as a result of inefficiency of the private investors. Customers were being unjustly estimated, they were being charged for service they did not enjoy, the outstanding bills became uncollectible for the company on daily basis because of its post-paid nature. Customers were ready to lynch the officials of the company if they (customers) were forced to pay for what they did not consume. However, the company saw the indebtedness as their assets, hence, ready to deploy every strategy in making sure the debts were recovered.

This trade-off brought as regards the commencement of pre-paid metering system in the year 2006 to relief customers from estimated and crazy bills as well as to aid and ease revenue collection by the company; an operation which is comparable to how a recharge card is loaded using the Global System for Mobile (GSM) technology. Pre-paid metering system enables the customer to pay for his/her electricity before being consumed. With the use of pre-paid energy meters, power utilities can collect electricity bills from customers before their consumption (Bourdillon & Godwin, 2013). The convenience and safety from embarrassments being witnessed by customers have made majority develop strong preference for pre-paid metering system. The customers are likely to have

developed preference for pre-paid meter/metering (PPM) as a result of perceived billing system.

The privatization process brought about the emergence of eleven distribution companies (known as DISCOs) (based on the existing distribution zones during the days of NEPA and PHCN) of which BEDC Electricity Plc is inclusive on November 1, 2013 (Usman, 2013). BEDC Electricity Plc was formerly Benin Distribution Zone of NEPA and PHCN. BEDC is used as a case in this study because it is the distribution company that supplies Ekiti State (area of study) with electricity. The fact that the privatized companies continue with the pre-paid metering process as introduced by the then PHCN in 2006 (during the government ownership of the sector) has made it worth of study.

### Statement of the Problem

A lot of empirical studies have been carried out on the concept of pre-paid electricity metering system by many foreign authors including Neenan (2010), Jean-Noel (2010) as well as Alam and Shahriar (2012) while in the developing nations, studies on the concept were also carried out by several authors including Kioko (2012), Miyogo, Nyanamba and Nyangweso (2013), Mburu and Sathyamoorthi (2014) among others as well as other few authors in Nigeria such as Usman (2013), Azodo (2014), and Damian, Uchechukwu and Euphenmia (2015). These researchers have concentrated their investigations on major cities and other urban areas while neglecting Ekiti State, hence, creating a gap in literature. They have also based their studies on various aspects of electricity pre-payment system but not dwelling deep into such area like perceived billing system, thereby creating another gap in literature. Moreso, they have all come out with different findings suitable to their environment but in conflict with othershence, these findings cannot be used to generalize the opinion of a peculiar state like Ekiti, therefore, the need for this study in order to guide the respective stakeholders with the result that would reflect the environmental peculiarity of the area of study (Ekiti State).

## II. LITERATURE REVIEW

### Pre-paid Electricity Metering System

Pre-payment metering allows electricity users to only use energy when they have credit in an electricity account because electricity "self-disconnects" when credit is depleted, in contrast to credit metering, whose billing system is based on the electricity units (kilowatts) that have already been consumed by the customer (Casarin & Nicollier, 2009). The number of clients who prefer to utilise pre-paid metres has increased globally (Jain, 2011).

Pre-paid metering, for instance, has long been an option provided to clients in the United Kingdom. A maximum of 15-20% of customers have chosen the option (Chisanga, 2006). In furtherance to this, Kettles (2004) claims that the system was created as a method of handling bad loans. In the 1980s, South Africa was the first country in Africa to implement electricity pre-payment meters in order to efficiently increase supplies to rural low-income homes and geographically dispersed users (Miyogo, Nyanamba & Nyangweso, 2013).

PPM was favoured by certain commercial customers who understood it over the post-paid billing method, which they claimed was expensive and had numerous hidden fees. ESKOM South Africa's energy utility firm had seen that providing service to remote areas under the post-paid billing system entailed considerable administrative costs before PPMs were introduced (Albert, Priscilla, Austine, Liliias, & Henry (2014). Additional service issues included the lack of postal addresses where energy bills could be sent, high rates of illiteracy among low-income households, which prevented them from fully understanding the post-paid billing system, and other issues (Tewari & Shah, 2003) and the inability to pay for accumulated electricity expenses brought on by employing a post-paid scheme (Miyogo, *et. al.*, 2013). Since that time, the pre-paid power billing system has gained popularity in a number of nations, including Argentina, Australia, Ghana, India, Kenya, Nigeria, Sierra Leone, Turkey, and many more (Albert, *et. al.*, 2014). Pre-payment enrollment with Northern Ireland Electricity has climbed to 25% thanks to the company's customer-friendly pre-payment system (Mburu & Sathyamoorthi, 2014). At Arizona's Salt River Project, more than 50,000 customers (about 6 percent) are on PPMs (Chisanga, 2006). According to Woodstock Hydro, 25% of residential consumers in Ontario have chosen to adopt the pre-paid scheme (Jain, 2011).

According to Chisanga (2006), the implementation of PPMs in the United Kingdom has significantly improved their efficiency in collecting money and decreased overheads, which has raised profitability. Customers using the pre-paid model consume 4.9 percent less electricity on average than post-paid customers, according to Northern Ireland Electricity (Jain, 2011). Pre-payment systems gained enormous traction in India and other developing nations by the late 2000s (Estache, Antonio, Foster, Viven, Wodon & Quentein, 2012). They might have attained their pinnacle growth in Great Britain (King, 2012). Pre-payment technology was first initiated in South Africa in the late 1980s with the intention of distributing energy to a sizable population of low-income and dispersed users in Africa. The method was primarily designed to reduce the

challenges posed by users' erratic revenues and the sparse infrastructure required for the delivery and receipt of credit slips (Tewari & Shah, 2003). The majority of energy supply businesses have been found to have significant customer debts, despite the fact that PPM usage among consumers has been rising across the continent. This makes it more difficult for them to provide high-quality service and effectively collect revenue. Some businesses used Revenue Cycle Management (CRM), a network operator cash policy that entails hiring private entities to recover outstanding debts from clients, as a solution to this issue; nevertheless, this strategy did not appear to have the desired impact (Annon, 2001).

Similar to this breakthrough, Power Holding Company of Nigeria (PHCN) Plc developed digital pre-paid meters in 2006; these meters operate similarly to how a recharge card works in a GSM phone (Emmanuel & Paul, 2010). In Kenya, such a system has been implemented (Jain, 2011). By June 30, 2012, around 123,000 PPMs had been placed throughout the nation (Kenya), with the majority of them being installed in Nairobi homes. In order to solve important issues including consumer education, logistics, and defective meters, the installation project was delayed. For other clients, the expectations, however, did not materialize. Some customers have expressed dissatisfaction over the fact that this pre-paid scheme is less effective than the previous one. Accordingly, Jain (2011) believes that faulty gadgets, poor consumer knowledge on how to use the new technology and confusing billing irked some consumers. Several households using pre-paid meters across the country elicited mixed reactions. While some users testify that the meters save electricity and costs, others have expressed dissatisfaction, citing various concerns.

### Perceived Billing System

There are many different uses for electricity (Alam & Shahriah, 2012). Electric utility authorities have historically used an average cost basis to recoup their installation, generating, transmission, distribution, system management, and return on asset costs (Alam & Shahriar, 2012). Time-dependent level power billing is the most popular method of electricity billing under the post-paid system. This is a billing system under which customers are being billed on an aggregate basis over the billing period usually a month. With this method, customers are responsible for paying for all of their kilowatt-hour (or kwh) consumption during the billing period, regardless of when the electricity is used (Alam & Shahriah, 2012). Usman (2013) believed that post-paid billing may in many circumstances not be the true/fair reflection of customers' consumption for the period but estimation.

Some pre-paid meter (PPM) customers are required to pay for all of their kilowatt-hour (kwh) consumption during the billing period under this arrangement, regardless of when the electricity is used (Albert, *et. al.*, 2014). Chisanga, (2006) demonstrated that because the tariffs on the new system were lower, users using the prepayment system were paying less for electricity than those using the old method. Due of the decreased tariffs in this specific instance, the bills were cheaper. Under the post-paid billing system, clients frequently complain about receiving overestimated amounts or occasionally no bills at all (Mburu & Sathyamoorthi, 2014).

Also, before the introduction of PPM in Nigeria in 2006 (Usman, 2013), perceives that customers are being faced with those problems such as inability to avoid large unpaid bills, un-easy resolution of disputes with the service provider officials, un-easy monitoring of their consumption and inability to budget in advance for electricity consumption. When the current credit limit is reached, a PPM disconnects itself; when the credit is replenished, it reconnects without charging a disconnection or reconnection fee. These savings are important because under post-paid service, disconnected customers must pay reconnection fee before he could be reconnected. They must also pay a deposit to establish service. These are significant financial hurdles. Customers with pre-paid service often cite these savings as benefit (Albert, *et. al.*, 2014). It was argued further that post-paid billing system has those disadvantages, among others, such as late delivery of bills to households resulting in debt accruals on the part of households combined with limited customer relations in the event of incorrect billing throughout the process of disconnecting and reconnecting (Chisanga, 2006).

A small number of customers, however, are vehemently opposed to PPM implementation because they believe it would unfairly push low-income customers into power outages. (Neenan, 2010). More so, it has been gathered through researches that most customers that enjoy relatively stable power supply, using heavy electric/electronic gadgets and having intention to evade full payments on these have really stood as oppositions to the adoption of PPM system (Usman, 2013). Most of these categories of customers often bye-pass the PPM in their premises, this is because it will force them to pay what they consume. This might have been perhaps, underestimated or the bill left un-paid under post-paid billing system (Neenan, 2010).

***H<sub>1</sub> = Perceived billing system does not significantly influence customers' preference for pre-paid electricity metering system***

## **Empirical Literature**

Neenan (2010) in his research conducted in Arizon's Salt River Project (SRP) in United States of America on paying upfront: A review of salt river project's M-Power pre-paid program, focus group survey method was adopted as an instrument of data collection, it was deducted that Arizon's Salt River Project (SRP) has operated M-Power, the largest electricity prepayment program since 1993 in the United States. In addition to the initial target population of customers with arrears facing service terminations and low-income customers, the customer population has increased to about 100,000 (or roughly 12% of all residents served by SRP), and it now includes customers with a variety of expectations from M-Power service. According to the researcher's findings, consumers' preferences for the adoption of PPMs are highly influenced by the following characteristics, among others: educational awareness, a sense of budget and control, savings, protection from embarrassments, and avoidance of monthly arbitrary costs.

Alam and Shariar (2012) conducted research on home power billing systems in Sylhet, Banglades: Is pre-paid system perceived as a better option by the subscribers? 50 customers from Sylhet city's post-paid and pre-paid systems participated in the survey, which was done in Bangladesh. questionnaires were used to collect the needed data. The results showed that the introduction of pre-paid billing for energy at homes is claimed to increase subscriber convenience, particularly by removing the inconveniences of bill payment associated with the post-paid system. User control over electricity consumption is one of the prepaid system's additional advantages, according to the findings. The study came to the conclusion that these benefits of pre-paid billing have greatly increased subscriber satisfaction levels when compared to those on post-paid billing.

Mburu and Sathyamoorthi (2014) carried out a research on switching form post-paid to pre-paid models: Customer perception and organisational role in managing the change: A case study of Botswana Power Corporation. 223 complete and useable questionnaires were received by the researcher, including 107 male and 116 female respondents. Of these, 27.3 had a secondary education, while nearly 70% had a higher education. A year ago, all of the aforementioned switched to pre-paid power, with about 73% of them living in Gaborone City and 27% in peri-urban areas. Approximately 12% of the respondents were self-employed, while about 82%, were government employees. This had an impact on responders who bought electricity at the end of the month or at the very least recharged monthly. A non-probability sampling method

was used. The results showed that buyers had accepted the pre-paid model. The authors emphasized further that these advantages, which significantly affect customers' preference for pre-paid models, include lower electricity costs with PPMs, customer fairness, health and safety, meter reliability, and user friendliness.

Albert, et. al. (2014) also carried out their research in Zambia based on the effects of the introduction of pre-paid meters on energy usage behaviour in different housing consumer groups in Kitwe, Zamba. The study identified some key issues vis-à-vis behavioural changes as a result of the introduction of PPMs, debt recovery and reduction of pilferage, disconnection of customers and alternative energy sources and feed-back. The data were collected in Kwacha (low income), Ndeke (medium income) and Parklands (high income). Both quantitative and qualitative data were employed. Through the use of 151 different structured questionnaires, quantitative data were gathered in the following ways: 42 high income, 50 medium income, and 59 low income individuals. Four households from each of the three household categories were subjected to in-depth interviews to gather the qualitative data. The key conclusions are that households are generally satisfied with the introduction of PPMs, with control over spending and no disagreements over bills cited as the main reasons. Numerous households claimed that their budgeting for energy has improved, and it appears that the proportion of households with previous debts has decreased. Finally, the study discovered that charcoal is now used for cooking in 21% of all households rather than electricity. The environment is likely to suffer as a result of this since deforestation may result. In order to eliminate the negative effects of homes moving from electricity to charcoal, the study highly advised that further research be done on the matter.

### III. RESEARCH METHODS

#### Research Design and Sample Size

Using the Yamane (1964) paradigm, a descriptive survey study methodology was used to administer mailed questionnaires to a sample of 381 BEDC power users in the Ado-Ekiti metropolitan. A total of 209 (54.8%) of the distributed questionnaires were successfully completed, returned, and compiled for the study. The questionnaire was divided into four (4) sections: Section (A) included sociodemographic information about respondents, as indicated in Table 2, and Section (B) included information about perceived product quality, which was taken from Garvin (1998) and Jarkpar, Na, Johari, and Myint, (2012);

variables related to perceived service quality were found in Section (C), which was adapted from Parasurama, Zeithaml & Berry (1998) and Carvalho and Leite (1999); additionally, variables related to customers' preferences were included in Section (D), which was adapted from Usman (2013). Customers' preferences are the dependent variable in this study, whilst perceived product quality and perceived service quality are the independent factors.

Every 21<sup>st</sup> customer on the BEDC list using pre-paid meter as derived through systematic sampling technique was administered a questionnaire through self-addressed envelope to their respective mail address extracted from the BEDC records. In order to encourage their commitment to participating in the survey and ensure that the completed questionnaire was returned to the attached address in the letter within two weeks, telephone courtesy calls were also employed as a follow-up method. Validities for both face and content were used. The research instrument was handed to subject-matter experts for them to evaluate the suitability of each instrument item based solely on appearance in order to guarantee its face validity. Their feedback together with that of the supervisors was utilised to create the final items, which were then put through content validity testing by the same experts, who ultimately determined the applicability of each item to the attributes being measured.

Both descriptive statistics (like rates and percentages) and inferential statistics (like correlation) were employed in the analysis.

### IV. RESULTS AND DISCUSSION

According to the results of the demographic section, which are shown in Table 1, there were 133 (63.35%) male respondents and 76 (36.4%) female respondents. Additionally, 50 (23.9%) and 40 (19.1%) of the respondents were between the ages of 51 and 55 and 46 and 50, respectively. Over 70% (151) of the respondents were married at the time of the examination, and 141 (67.5%) had completed tertiary education. Additionally, according to the demographic results, 121 (58%), 61 (29%) and 27 (13%) respondents were, respectively, residential, commercial, and special users.

According to the extracted data, the majority of pre-paid meter users in the Ado-Ekiti metropolis are adults who are married, educated, and who are in charge of paying the power bills for their individual apartments. As a result, information gathered from this group of people can be trusted and taken seriously when supporting the study's findings.

Table 1: Demographic Distribution of Respondents

Variables	Frequency	Percent
<b>Gender Distribution</b>		
Male	133	63.6
Female	76	36.4
<b>Total</b>	<b>209</b>	<b>100.0</b>
<b>Age Distribution</b>		
30-35 Years	44	21.1
36-40Years	37	17.7
41-45 Years	33	15.8
46-50 Years	40	19.1
51-55 Years	50	23.9
56Years and Above	5	2.4
<b>Total</b>	<b>209</b>	<b>100.0</b>
<b>Marital Status</b>		
Single	23	11.0
Married	151	72.2
Divorced	12	5.7
Widow	23	11.0
<b>Total</b>	<b>209</b>	<b>100.0</b>
<b>Educational Qualification</b>		
Informal Education	10	4.8
Primary	14	6.7
Secondary	44	21.1
Tertiary	141	67.5
<b>Total</b>	<b>209</b>	<b>100.0</b>
<b>Customer</b>		
Residential	121	57.9
Commercial	61	29.2
Special	27	12.9
<b>Total</b>	<b>209</b>	<b>100.0</b>

Source: Field Survey, (2023)

#### 4.1 Statistical Testing of Hypothesis

##### 4.1.1 H<sub>1</sub>: Perceived Billing System and Customers' Preference of PPM

The correlation of two variables, perceived billing system and customers' preference were analyzed. Data were obtained from 209 respondents using Pearson Moment

Correlation (PPMC). The result as presented in Table 2 shows that there is significant relationship between perceived billing system and customers' preference ( $r(209) = +0.358, p < 0.05$ ). Obtaining a probability of 0.000 which is less than 0.01 significance level for a two-tailed test, the perceived billing system and customer preference for pre-paid electricity metering system is significant.

Therefore, we reject the null hypothesis and accept the alternative hypothesis.

The result of this study support the findings of Albert, *et al.*, (2014) who fund showed that households are generally satisfied with the introduction of PPMs, citing control over spending and the absence of bill disputes as the key reasons. Numerous households claimed that their budgeting for energy has improved, and it appears that the proportion of households with previous debts has decreased. The finding also supports the study of Alam and Shahriah (2012) who concluded that the introduction of pre-paid billing for energy at homes is claimed to increase subscriber convenience, particularly by removing the inconveniences of bill payment associated with the post-paid system.

The result could be because of the numerous benefits that customers derive from the pre-paid billing. The finding supports the study of Mburu and Sathyamoorthi (2014) who found that consumers have accepted pre-paid billing and are aware of its advantages. The authors emphasised further that these advantages, which significantly affect customers' preference for pre-paid models, include lower electricity costs with PPMs, customer fairness, health and safety, meter reliability, and user friendliness. The finding also supports the conclusion of Neenan (2010) that customers' preferences for the adoption of PPMs are highly influenced by the following criteria, among others: educational knowledge, a sense of budget and control, savings, protection from embarrassments, and avoiding monthly random fees.

Table 2: Correlation Co-efficient between Perceived Billing System and Perceived Customers' Preference

Variables		Perceived Billing System	Perceived Customers' Preference
Perceived Billing System	Pearson Correlation	1	.358**
	Sig. (2-tailed)		.000
	N	209	209
Perceived Customers' Preference	Pearson Correlation	.358**	1
	Sig. (2-tailed)	.000	
	N	209	209

\*\*Correlation is significant at the 0.01 level (2-tailed).

Source: Data Analysis (2023)

**V. CONCLUSION AND RECOMMENDATIONS**

The study concluded that perceived billing system has significant influence on customers' preference for pre-paid electricity metering system. This implies that electricity customers in Ado-Ekiti, Ekiti state perceive avoidance of arbitrary billings as key parameters in accepting pre-paid meters while making their preferences. It further concluded that pre-paid system has brought with it some advantages like reduced/arbitrary power disconnections, no payment of reconnection fees. Besides, making customers to be more careful with their consumption and ability to budget for their electricity usages.

As a result of the multiple benefits connected with them, it is advised that BEDC's management make prepaid meters available to her many consumers at an affordable price. Also, since majority of the electricity customers in Ado-Ekiti metropolis found the introduction of PPM system useful, it is recommended to be extended to all the rural towns and villages of Ekiti State in order to save them

from arbitrary billing, indiscriminate disconnections and perpetual payments of reconnection fees.

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