

# Electricity Billing Systems at Residential Level in Sylhet City: Is Pre-Paid System perceived as a Better Option by the Subscribers?

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## Abstract

The introduction of Pre-Paid billing system for electricity at households are claimed to be an addition to the convenience of subscribers, especially by excusing the hassles of bills payments associated to the Post-Paid system. Among the other benefits of Pre-Paid system, user control over electricity consumption, freedom from discrepancies regarding to billing etc. are largely spoken about. These conveniences brought by the Pre-Paid billing system should therefore, obviously result in a higher satisfaction level of the subscribers compared to those of the Post-Paid system. But, any such systematic and focused study is yet to have taken place, although that might carry mentionable significance from a number of perspectives. This study is a humble yet strongly rooted quest to address the very issues that contributes to the satisfaction levels of the subscribers of electricity at household levels. Conducted on 50 subscribers from both Pre-Paid and Post-Paid systems of Sylhet city, this study can be considered as ‘Small Scale’ that aims to construct a comparative picture of the satisfaction level of the subscribers of the two systems on the benchmark issues. The backbone of the study is the information acquired through a questionnaire survey conducted through ‘In Home’ type of personal interviewing. Along with the generation of findings, the study offers some implications and recommendation that may be used at policy levels.

**Keywords:** Pre-Paid and Post-Paid electricity billing system, Residential level electricity, Subscriber satisfaction, Comparative study, Questionnaire survey.

## 1. Introduction

The history of electricity generation in Bangladesh dates back to 1901, when the Nawab of Dhaka took the maiden initiative in this regard. Following that event, the first commercial electricity distribution company, privately owned M/S DEVCO started serving mostly the wealthy citizens of this city in the early 30’s. Later on, the sector was nationalized and continued to serve public under government control until the beginning of the new millennium, when private owned limited capacity power plants are authorized. Bangladesh, especially the metropolitan cities have experienced significant changes in the structure and regulations in electricity distributing bodies. At the same time, the consumers of these areas have experienced a massive transformation in the billing system and payment options for electricity at the household level.

The introduction of pre-paid electricity billing system has been a milestone transformation from the long practiced traditional post-paid system. Buying certain units of electricity credits from the government outlets, the subscribers are claimed to be free of the bill payment hassles that are experienced by the post-paid subscribers. On the other hand, the post-paid subscribers, too, have experienced the convenience of paying bills through more than one option. Compared to the only option available at past, the banks, post paid subscribers now have the options to pay bills through bills pay outlets and even their own mobile phone (in some cases).

In this instance, the question whether pre-paid electricity billing system has really created the difference in subscriber convenience, or whether post-paid subscribers are getting the upper hand, may be an issue of debate. As subscribers of both of the billing systems have their own pros and con’s, a comparative study on the user satisfaction would be appropriate to address the issue.

## 2. The structure of Electricity market, Pricing systems and Metering options practiced in Bangladesh:

To produce almost all goods and services the Electricity is crucial and it is critical to the civic interest. Businesses and households rely on electronic devices to perform huge range of tasks, both fundamental and higher. As a consequence, reliable systems, adequate, competitive priced electricity is essential for modernization, domestic growth, and international competitiveness— and is among the most urgent challenges facing developing and transition economies (Kessides 2004). Most electricity industries were vertically integrated monopolies owned by national, state, or municipal governments (Joskow 2003) but over the past decade, views have changed dramatically on how electricity should be owned, organized, and regulated

(Newbery 2000, 2001). There are numerous perspectives and lessons on the most important reform issues and policy options for electricity systems in several developing and transition economies. However, a multi-national research project, Task VI of the International Energy Agency's Demand-Side Management Program, developed four generic models for the structure of electricity industries (Energy Futures Australia, 2004). The four models are: Model 1 - Vertically integrated monopoly, Model 2 - Unbundled monopoly (Single buyer), Model 3 - Unbundled, limited competition (Wholesale competition) Model 4 - Unbundled, full competition (Retail competition). (Brown et. all. 2006). In Bangladesh, the Power Division, Ministry of Power, Energy & Mineral Resources (MPEMR) controls the electricity market through the Bangladesh Energy Regulatory Commission (BERC). Government allows public and Independent Private Producers (IPPs) to produce electricity and transmit through Power Grid Company of Bangladesh Ltd (PGCB) to the various distributors to serve the consumers. Thus the nature of the structure of electricity market portrays the 'Single buyer Model'. But the BPDB plans to adopt Multi buyer/Competitive pool when the market becomes mature and stable (MPEMR, 2008).

### 2.1 Electricity Billing Systems

Electricity is a multifarious product. Traditionally, electric utilities authorities have been recovering their costs of installation, generation, transmission, distribution, system management and return on asset on an average-cost basis and two general rate designs are followed to charge on customers. First, Time-independent "level" electricity price, where price has been measured and billed on an aggregate basis over the period of an total billing rotation – usually one month. Under this system, customers pay for electricity based on their entire consumption measured (in kilowatt-hours) over the billing period regardless of when the electricity is demanded and Second, a time-of-use (TOU), price structure that charges higher rates during "peak" times and lower rates off-peak times (Walawalkar *et al*, 2004 and Borenstein, 2007). (Ericson, 2006). For industrial or commercial use of electricity often different pricing options are followed like two-part tariff structure, i.e. one part for capacity (or demand) drawn and the second part for actual energy drawn during the billing cycle. Capacity or demand is in KW terms; three-part time-of-day tariff has been reported where the bill is imposed sub-totaled for specific lengths of peak, off-peak and mid-peak period's usage (Ahmed and Hossain 1998). Bangladesh Power Development Board (BPDB) charges different electricity prices on the basis of user categories (BPDB, 2011) using KWH approach with flat rate in every month ignoring the time of use. The categories of users are A : Residential light & power B : Agricultural pumping category C : Small industrial category D : Non-residential light & power E : Lt commercial rate F : Medium voltage general purpose (11 kv) G-1 : Extra high voltage DESA (132 kv) G-2 : Extra high voltage general (132 kv) H : High voltage general purpose (33 kv) I : High voltage bulk supply for rural electrification of board/ Palli Biddyut Samiti J : Street light and water pumps. Rather, the BPDB has been applied 'three-part time-of-day tariff 'on 30 representative industrial consumers (Ahmed and Hossain 1998).

### 2.2 Metering options

An electricity meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered tool. There has a different type of electric meters used to calculate the household or commercial consumption of electricity (Shaw, 2011), such as: Electromechanical Induction Meter or Standard Meter, Variable Rate Electric Meters, Prepayment Electric Meters, Solid State Electric Meters and Electronic Meters. In 1972, Bangladesh Power Development Board (BPDB) was established and from the beginning, the BPDB is exercising Electromechanical Induction Meter or Standard Metering system where the human interface-meter reader- notes the consumed unit of electricity shown on the meter and bill is imposed on the customers along with other costs. However, the BPDB experiencing power lost or remains unaccounted for in part due to "procedural losses" at the production, transmission and distribution lines, but most due to "non-technical losses" on customer level when customers tamper with their meter, hatch up with the meter reader or illegally connect directly to the distribution line, the power company loses a lot of money (Rahmatullah et. al, 2008). In this essence, Bangladesh Energy Regulatory Commission (BERC) was established to reform and administer the energy sector properly. For the first time in the year of 1995, the BPDB thought to introduce pre-payment electric meter in the country and finally introduced in the year of 2005 at some selected area of Chittagong Metropolitan City, Uposohar residential area of Syllet Metropolitan City, Bogra City, Sirajganj City and Uttara residential area of Dhaka Metropolitan City as pilot projects.

### 3. Energy Consumption Behavior at Household Level: A Literature Review

A large number of studies have been found on the nature of energy consumption behavior of the households which have addressed the different issues related to the decision making, consumption and satisfaction level of the subscribers. Studies investigating the decision to make an energy conservation improvement took into consideration various characteristics of household units' and its occupants. A survey conducted by Olsen (1983) in the State of Washington in spring 1981 revealed that sex of the respondent is not statistically significantly related to acceptance of energy conservation strategies. Energy use and acceptance of energy conservation strategies are positively related to educational level of the respondent (Held, 1983; Olsen, 1983), while less educated respondents prefer behavioral energy conserving measures (Poortinga et al., 2003) and are more conscious of energy problems (Samuelson and Biek, 1991). However, education of the respondents has no significant influence neither on the number of household energy conservation actions (Curtis et al., 1984), or on the actual energy consumption (Ritchie et al., 1981). Family size and composition, presence or absence of family members from home, have a direct effect on energy behavior and use (Van Raaij and Verhallen, 1983). In fact, family size was positively related to in-home energy consumption with households comprised of two to four people took a greater number of actions than households of differing size (Curtis et al., 1984). Households residing in large dwellings, as measured by the number of rooms and number of floors, are energy intensive consumers (Ritchie et al., 1981). So, the older and larger the dwelling, the more likely that households will engage in an energy conservation improvement (Walsh, 1989).

Numerous empirical studies examined age of the respondent as a predictor variable for energy conservation actions (Ritchie et al. 1981, Hirst and Goeltz1982, Brandon and Lewis (1999). In his study for Canadian households Walsh (1989) argued that younger heads of households are more likely to make a conservation improvement. In general, the older the person is, the less likely she or he is to adopt energy conservation strategies (Olsen, 1983; Berry and Brown, 1988; Brown and Rollinson, 1985; Poortinga et al., 2003).

Home ownership may be a critical determinant of energy efficiency responses. As Stern and Gardner (1981) argued home ownership set downs the type of energy conservation behavior that residents would adopt. More precisely, efficiency measures are more available to consumers and to homeowners, whereas curtailment may be the only option for renters. Curtis et al. (1984), examined the relationship between house tenure and the number of reported conservation actions, and concluded that although form of home tenure was not significantly associated with number of actions, those who owned their homes declared a slightly greater number of actions than renters. In addition, Black et al. (1985), based on answers of 478 residents of Massachusetts during the summer of 1980, argued that homeownership had the strongest direct effect on investments in energy efficiency. Domestic income is a governing forecaster of energy use behaviors (Held, 1983). Ritchie et al. (1981) results confirmed that family income was positively related to in-home energy utilization. Another analysis confirmed that households with higher incomes consume more energy sources (Brandon and Lewis, 1999). In an econometric estimation of determinants of energy conservation expenditures Long (1993) proved that income level of the households was positively and statistically related to larger conservation investments. Kasulis et al. (1981) had argued that if a household belongs to a low income group, they are already very likely to be using low amounts of energy and thus would not have the ability to respond to requests for greater conservation activity. A survey of 1200 households in Ireland conducted by Scott (1997) supported the assumption that restricted access to credit and transactions costs (such as time and effort) made residential conservation actions prohibitive. Finally, lower income respondents were more sensitive to energy problem (Samuelson and Biek, 1991).

### 4. Objectives of the Study

The primary objective of the study includes studying the household consumers of both pre-paid and post-paid electricity to measure their level of satisfaction regarding to the benchmark issues of the billing systems. As per the locus of the study, the inherent objective has been to construct a comparative picture of the satisfaction levels of the pre-paid and post-paid subscribers to derive insights and implications. However, the specific objectives of the study are as follows:

- To identify the issues of pre-paid and post-paid electricity billing systems contributing to the level of satisfaction of the subscribers living in Sylhet city.
- To conduct study on the pre-paid and post-paid electricity subscribers of Sylhet city to measure the level of satisfaction regarding to individual issues and at an aggregate level.
- To compare between the level of satisfaction of pre-paid and post-paid subscribers at individual issues and aggregate level.
- To derive the implications of the findings of the study through relevant analysis.
- To offer relevant recommendations for implementation at policy levels.

## 5. Methodology of the Study

This study is descriptive in nature and includes the use of both primary and secondary data. The methodology for the study is as follows:

### 5.1 Definition of Population and Geographic Coverage of the Study

The population of the study is comprised of the household electricity subscribers, both pre-paid and post-paid billing system, of Sylhet city of Bangladesh. The pre-paid electricity billing system is available in the 'Shahjalal Uposhohor' residential area of the city only. Rest of the city's electricity follows the post-paid billing system. The study covered subscribers residing in the different areas of the city.

### 5.2 Sampling technique and sample size

For the small scale nature of the study other situational constraints, convenient sampling techniques has been used to select the respondents from the population of the study. Of the two samples of the study, one is constructed by selecting fifty (50) pre-paid subscribers and the other by fifty (50) post-paid subscribers.

### 5.3 Qualitative Research

For the qualitative study, secondary data analysis and focus group study have been conducted. Articles of research journals, texts, periodicals and different internet resources have been found useful while conducting the secondary data analysis. A short focus group consisting of conveniently chosen three (03) pre-paid and three (03) post-paid subscribers has been conducted to identify the benchmark issues that contribute to the level of satisfaction regarding to electricity billing. The focus group has primarily identified a number of issues influencing subscribers' satisfaction level. After secondary and tertiary screening by the group, the following factors have been identified and included in the final study:

- Subscribers' perceived convenience regarding to the mode of payment for electricity (purchasing pre-paid cards / paying post-paid bills in the 'Bills Pay' centers).
- Subscribers' perceived convenience regarding to process of payment for electricity (recharging process of pre-paid cards / payment process in 'Bills Pay' centers).
- Subscribers' perceived convenience regarding to the length of availability of the payment services for electricity (working hours of pre-paid cards outlets / 'Bills Pay' centers).
- Subscribers' perceived convenience regarding to the number of available service centers for the payment in any area (number of pre-paid cards outlets / 'Bills Pay' centers).

### 5.4 Quantitative Study

The quantitative study, in the form of a questionnaire survey on the selected samples has collected data on the benchmark issues identified in the focus group. The collected data have been used to test the research hypotheses and address the research problem. The survey was conducted following the 'In Home' type of personal interviewing technique. The respondents have been pre-screened and contacted before the interview. Later, they have been interviewed at their residences. The questionnaire used for survey is given in Annex-I.

### 5.5 Data Analysis and Interpretation

SPSS software has been used to analyze the data generated from the quantitative study. Both descriptive and inferential statistical analysis has been employed for the analysis. The descriptive statistics have been used to acquire a meaningful insight of the samples and the data set. Inferential statistics i.e. 'Mann-Whitney' test and 'Two-Sample Kolmogorov-Smirnov' test have been used to test the research hypotheses and drawing results of the study. The results of the hypotheses test have been translated into the findings of the study.

## 6. Statement of Research Problem

The research problem of the study is:

'To measure and compare the level of satisfaction regarding to the pre-paid and post-paid electricity billing system among the household subscribers living in Sylhet city'.

## 7. Research Questions

The research questions of the study are:

- Do the pre-paid subscribers perceive different level of convenience regarding to purchasing pre-paid cards from pre-paid cards outlet(s) than that of the post-paid subscribers regarding to paying bills in 'Bills Pay' centers?

- Do the pre-paid subscribers perceive different level of satisfaction regarding to the process of issuing and recharging process of pre-paid cards than that of the post-paid subscribers regarding to the charges taken while paying bills in 'Bills Pay' outlets / through own post-paid cell phone connections?
- Do the pre-paid subscribers perceived different level of convenience regarding to the number of the pre-paid cards outlet(s) than that of the post-paid subscribers regarding to the number of the 'Bills Pay' outlets?
- Do the pre-paid subscribers perceived different level of convenience regarding to the working hours of the pre-paid cards outlet(s) than that of the post-paid subscribers regarding to the working hours of the 'Bills Pay' outlets?
- Do the pre-paid subscribers possess a different level of overall satisfaction regarding to their subscribed billing system than that of the post-paid subscribers regarding to their subscribed billing system?

## 8. Research Hypothesis

Based on the research problem, the hypotheses of the study are:

*Null Hypothesis 1:* There is no difference between the perceived convenience of the pre-paid subscribers regarding the purchase of pre-paid cards from pre-paid cards outlet(s) and that of the post-paid subscribers regarding the payment of electricity bills through 'Bills Pay' outlets / own post-paid cell phone connection.

*Null Hypothesis 2:* There is no difference between the satisfaction level of the pre-paid subscribers regarding to the issuing and recharging procedure of pre-paid cards and that of the post-paid subscribers regarding to the charges taken while of paying bills in 'Bills Pay' outlets / own post-paid cell phone connection.

*Null Hypothesis 3:* There is no difference between the satisfaction level of the pre-paid subscribers regarding the number of the pre-paid cards outlet(s) and that of the post-paid subscribers regarding the number of the 'Bills Pay' outlets.

*Null Hypothesis 4:* There is no difference between the perceived convenience of the pre-paid subscribers regarding to the working hours of the pre-paid cards outlet(s) and that of the post-paid subscribers regarding to the working hours of the 'Bills Pay' outlets.

*Null Hypothesis 5:* There is no difference between the overall satisfaction level of the pre-paid subscribers regarding their subscribed billing system and that of the post-paid subscribers regarding their subscribed billing system.

For each Null Hypothesis ( $H_0$ ), a corresponding Alternative Hypothesis ( $H_1$ ), implying that, the level of convenience / satisfaction of the pre-paid subscribers are different compared to that of the post-paid subscribers, has been taken to test statistically based on the data collected through survey.

## 9. Projection of Survey Data

### 9.1 Profile of the Respondents

The gender wise distribution of respondents is heavily skewed on the male side, where 90% were male and only 10% were female. The social structure of household works distribution may be the reason here, where the male members of families mainly deals with outdoor activities like paying bills or purchasing cards from outlets. The age group of respondents is distributed as 54% in the 18 to 28 years, 19% in the 28 to 45 years and 27% in the above 45 years group. Among the 100 respondents, 13% are government service holders, 29% are private service holders, 22% are business people, 28% are students and 8% are homemakers. Thus the survey has covered almost all the professional strata of the population. The income distribution of the respondents also covers a wide variety of income groups where 34% fall within income level upto BD TK. 30000, 51% percent within income level between BD TK. 20000 to BD TK. 40000 and 15% in the above BD TK. 40000. 56% of the respondents live in their own houses and 44% live in rented ones. The family size of the respondents are distributed as, 18% consisting 2-3 members, 57% consisting 4-5 members and 25% consisting more than 5 members. 16% of the respondents live in houses with 2-3 rooms, 43% in houses with 4-5 rooms and 41% in houses with more than 5 rooms. Only 16% of the respondent households use air conditioners. Where, the pre-paid subscribers have only one option to purchase top up cards and that is from the BPDB office situated at Shahjalal Uposhor area of Sylhet city, the post-paid subscribers have the option to pay electricity bills either through the 'Bills Pay' outlets of Grameen Phone situated at almost every area of the city, or through post-paid mobile connections of Grameen Phone. But the no respondents have been found to have used the second option in the study. Regardless to the type of subscription, the expenditure for household electricity has the following distribution: 15% of the respondents' households paid BD TK. 300 to BD TK. 600 in the previous month of the study, where 36% paid BD TK. 600 to TK 1000, 23% paid BD TK. 1000 to BD TK. 1500, 15% paid BD TK. 1500 to BD TK. 2000 and 11% percent paid more than BD TK. 2000.

### *9.2 Statistics Regarding to Respondents' Perceived Conveniences and Satisfactions*

The basic statistics of the responses regarding to the perceived conveniences and satisfactions are given in Table 1. The statistic shows a vary slightly negatively skewed distribution of the responses except for the case of the satisfaction level compared to previously subscribed billing system. On a '1 to 5' scaling system representing 1 as the most negative response and 5 as the most positive response, the modal response category has been mostly on the positive side (category 4 representing feeling convenient or satisfied and category 3 representing a neutral attitude).

*[Inert Table 1 about Here]*

### *9.3 Level of Perceived Convenience in Purchasing Cards / Paying Bills*

The level of convenience felt by the respondents in purchasing pre-paid cards or paying post-paid bill for household electricity consumption has a heavier distribution on the positive side on an aggregated level, where 42% of the respondents feel convenience and 7% feel extreme convenience in this regard. On the other hand, a mere 8% feel inconvenience and only 3% feel extreme inconvenience in this regard. However, a significant 40% of the respondents have perceived neither convenience nor inconvenience in this regards, thus not giving any decisive response. From a billing system wise point, level of perceived convenience of the pre-paid subscribers is 2%, 12%, 26%, 56% and 4% for response categories 'Extremely Inconvenient', 'Inconvenient', 'Neither Convenient nor Inconvenient', 'Convenient' and 'Extremely Convenient' respectively and the perceived convenience of the post-paid subscribers is 4%, 4%, 54%, 28% and 10% for the same response categories.

*[Inert Table 2 about Here]*

### *9.4 Level of Satisfaction Regarding the Processes and Charges*

The respondents' satisfaction level with the process of issuing and recharging pre-paid cards / process and charges taken in the 'Bills Pay' outlets are as well, heavily distributed in the positive side. Although none was found to be highly satisfied, 42% respondents are satisfied in this regards, where 17% are dissatisfied and 5% are highly dissatisfied with the same. In this case, too, a significant 36% of the respondents did not express any decisive attitude. From a billing system wise point, level of satisfaction level of the pre-paid subscribers is 4%, 4%, 30%, 62% and 0% for response categories 'Highly Dissatisfied', 'Dissatisfied', 'Neither Satisfied nor Dissatisfied', 'Satisfied' and 'Highly Satisfied' respectively and the satisfaction level of the post-paid subscribers is 6%, 30%, 42%, 22% and 0% for the same response categories.

*[Inert Table 3 about Here]*

### *9.5 Attitude towards the Number of Services Outlets and Their Working Hour*

The respondents' attitude towards the number of pre-paid card outlet and 'Bill Pay' outlet are given in the Table 4 and 5. Although majority of the respondents are on the satisfaction side regarding the number of outlets, 52% of the respondents are indifferent about the working hours of these outlets. From a billing system wise point, level of satisfaction level of the pre-paid subscribers is 2%, 18%, 38%, 42% and 0% for response categories 'Highly Dissatisfied', 'Dissatisfied', 'Neither Satisfied nor Dissatisfied', 'Satisfied' and 'Highly Satisfied' respectively and the satisfaction level of the post-paid subscribers is 0%, 36%, 18%, 40% and 6% for the same response categories (Please refer to Annex-III). Again, from a billing system wise point, level of perceived convenience of the pre-paid subscribers is 8%, 24%, 40%, 26% and 2% for response categories 'Extremely Inconvenient', 'Inconvenient', 'Neither Convenient nor Inconvenient', 'Convenient' and 'Extremely Convenient' respectively and the perceived convenience of the post-paid subscribers is 0%, 18%, 64%, 18% and 0% for the same response categories.

*[Inert Table 4 and Table 5 about Here]*

### *9.6 Overall Satisfaction Level with the Billing Systems*

The respondents' overall satisfaction level with their subscribed billing system shows a highly positive distribution, where a massive 77% of the respondents are on the satisfaction side and only 9% are on the dissatisfaction side. 14% of the respondents are indifferent in this regard. From a billing system wise point, level of satisfaction level of the pre-paid subscribers is 4%, 2%, 8%, 82% and 4% for response categories 'Highly Dissatisfied', 'Dissatisfied', 'Neither Satisfied nor Dissatisfied', 'Satisfied' and 'Highly Satisfied' respectively and the satisfaction level of the post-paid subscribers is 8%, 4%, 20%, 64% and 4% for the same response categories.

*[Inert Table 6 about Here]*

### 9.7 Comparative Satisfaction and Switching Intention

Among the 100 respondents surveyed, 47 of them had experience subscribing to other types of billing system earlier. Among them, 2 respondents did not give any response towards their comparative satisfaction and intention to switch back to previous billing system. The responses of the rest 45 respondents are given in table 7 and 8. Nearly 23% of these respondents expressed an intention to switch back to their previous billing system despite having a high level of dissatisfaction in total with their existing billing system. If the billing system wise responses are looked into, then the inherent reason becomes evident. Only 12.5% of the pre-paid subscribers expressed their intention to switch back to post-paid billing system. On the other hand, all of the post-paid subscribers would like to switch back to the pre-paid system. Due to this absolutely skewed response by the post-paid subscribers, the overall switching intention in total has an arbitrary nature.

*[Inert Table 7 and Table 8 about Here]*

## 10. Analysis and Findings

### 10.1 Results of Hypotheses Testing

The hypotheses of the study have been tested through the use of three different statistical tools, namely 'Mann-Whitney Test', 'Independent Samples T Test' and 'Two Sample Kolmogorov-Smirnov Test' to compare between the responses patterns of the pre-paid subscribers and post-paid subscribers. The 'Mann-Whitney Test' test yields '2-Tailed' p values of 0.248, 0.000, 0.682, 0.795 and 0.060 for the Null Hypotheses 1 to 5 respectively. From the test statistics, it can be implied that, except for Hypothesis 2, the other statistics are not insignificant and thus, there is no mentionable differences between the satisfaction level / attitude expressed by the pre-paid and post-paid subscribers. Thus, Null Hypotheses 1, 3, 4 and 5 can be accepted. However, there is an extremely weak similarity between the overall satisfaction level of the pre-paid and post-paid subscribers, as the significance level (0.060 here) is very close to the least minimum level (0.060). For Null Hypothesis 2, the significance level is 0.000. Thus, the Null Hypothesis can be accepted, implying that, there is significant level of difference between the attitude of pre-paid subscribers towards the process of issuing and recharging cards and that of the post-paid subscribers toward the charges taken in 'Bills Pay' outlets / own post-paid cell phone connection. Also the negative value of 'Z' implies that, the pre-paid subscribers possess a higher level of satisfaction compared to the post-paid subscribers in this regard. The 'Two-Sample Kolmogorov-Smirnov Test' yields '2-Tailed' p values of 0.178, 0.001, 0.711, 0.544 and 0.393 for the Null Hypotheses 1 to 5 respectively and thus, supporting the results and implications found in the 'Mann-Whitney Test' mentioned earlier.

*[Inert Table 9 and Table 10 about Here]*

### 10.2 Relationship between Overall Satisfaction Level and Type of Billing System

To find out any association between the level of overall satisfaction and type of billing system, a 'Pearson Chi-Square' test has been performed on the cross tabulation data of the two variables [Please refer to Annex-III]. The Chi-Square test yields a '2-Sided' p value of 0.322 thus implying that the test statistic is insignificant. Therefore, no association has been found between the level of overall satisfaction and type of billing system. However, the contingency coefficient value (0.211 here) implies that, the two variables are slightly dependent.

*[Inert Table 11 about Here]*

### 10.3 Findings of the Study

From the information derived from the different analyses, the following findings can be generated:

- There is no significant difference found between the perceived convenience of the pre-paid subscribers regarding the purchase of pre-paid cards from pre-paid cards outlet(s) and that of the post-paid subscribers regarding the payment of electricity bills through 'Bills Pay' outlets / own post-paid cell phone connection.
- There is a significant difference found between the satisfaction level of the pre-paid subscribers regarding to the issuing and recharging procedure of pre-paid cards and that of the post-paid subscribers regarding to the charges taken while of paying bills in 'Bills Pay' outlets / own post-paid cell phone connection.
- There is no difference found between the satisfaction level of the pre-paid subscribers regarding the number of the pre-paid cards outlet(s) and that of the post-paid subscribers regarding the number of the 'Bills Pay' outlets.
- There is no difference found between the perceived convenience of the pre-paid subscribers regarding to the working hours of the pre-paid cards outlet(s) and that of the post-paid subscribers regarding to the working hours of the 'Bills Pay' outlets.
- There is no difference found between the overall satisfaction level of the pre-paid subscribers regarding their subscribed billing system and that of the post-paid subscribers regarding their subscribed billing system.

- No relationship has been found to exist between the level of overall satisfaction and the type of subscribed billing system.
- Finally, from the tests and analyses conducted in the study, it can be implied that, pre-paid electricity has not been able to establish itself as a better option over post-paid electricity as the subscribers of either billing system shows no mentionable difference in level of user satisfaction.

### 11. Implications and Recommendations

Based on the analysis and findings of the study, the following implications may be inferred and taken into consideration while developing related policies and regulations:

- There is no significant difference found in the satisfaction level of the pre-paid and post paid electricity users. The pre-paid electricity system was launched to provide better services to the subscribers as well as to attain other objectives. So, the authority should think about the loopholes of systems to ensure the customer satisfaction.
- Post paid users are more satisfied in paying bills than prepaid users as post paid user have opportunity to pay bills through the mobile phones at nominal costs. Thus they can avoid long queue and complex procedure of prepaid card issuing that are experienced by the prepaid users. In this situation, pre-paid authority can arrange prepaid card issuing in through mobile phones or bills pay outlets similar to post paid system which will ensure the freedom of the subscriber.
- Pre-paid system has some pitfalls. If a subscriber exhausts the utility in off- hour or off-day, instantly the power cut will occurs until the next recharge. Rather the service charge imposed on a subscriber in each and every recharge though it is made on the same month and result is, customers have to pay more money than the post paid subscribers. To solve the problems, the authority may introduce a window to serve 24 X 7 which will ensure the availability of the recharge regardless to the time and days.
- Number of outlets should be increased in both prepaid and post paid electricity but it is more essential for the prepaid systems because in a large geographic area is covered by only one service outlet which is extremely pressure on the executives of the center as well as on the subscribers.
- There is no promotion of the values of the prepaid electricity systems. The authority should communicate with subscribers regularly to make them perceive that it is better options for them.
- There is no option for the subscriber to choose the post paid or prepaid electricity as it fixed in certain areas. If any customer perceives one system is superior over other, he has no options to switch to the desired one unless he changes his residence which is barely feasible.

### 12. Conclusion

Prepaid electricity has great opportunities. Many countries are practicing this system. In Bangladesh, the system was initiated as pilot projects but because of some loophole the customers do not perceive it as better options though it has some significant benefits. If the authority takes the proper measures to reduce the drawbacks of the system, it can contribute to the countries economy in many ways. This paper is strongly recommending taking effective measures which will ensure that electricity subscribers should consider the prepaid electricity system as the better option for household electricity consumption.

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Table 1: Statistics Regarding to Respondents' Perceived Conveniences and Satisfactions

Statistics	Nature of Data	Level of convenience in paying for cards / bills through respective payment methods	Attitude towards the process of recharging cards / charges taken in 'Bills Pay' outlets	Attitude toward working hour of outlets	Attitude toward number of outlets	Overall satisfaction to subscribed billing system	Has the respondent subscribed to other billing system before?	Satisfaction with current billing system compared to previous	Switching intention to the other type of billing system
Number of Response	Valid	100	100	100	100	100	100	45	45
	Missing	0	0	0	0	0	0	55	55
Mean		3.42	3.15	2.95	3.18	-	-	2.18	-
Std. Error of Mean		.085	.088	.080	.090	.086	.050	.128	.063
Modal Response		4	4	3	4	4	-	-	-
Std. Deviation		.855	.880	.796	.903	.855	.502	.860	.420
Skewness		-.537	-.753	-.277	-.199	-1.946	-.122	1.657	-1.383

Table 2: Level of convenience in paying for cards / bills through respective payment methods

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Extremely Inconvenient	2.0	4.0	3.0
2	Inconvenient	12.0	4.0	8.0
3	Neither Convenient nor Inconvenient	26.0	54.0	40.0
4	Convenient	56.0	28%	42.0
5	Extremely Convenient	4.0	10%	7.0
9	Missing Value	0	0	0
	Total	100.0	100.0	100.0

Table 3: Satisfaction level the process of issuing and recharging pre-paid cards / process and charges taken in 'Bills Pay' outlets

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Highly Dissatisfied	4.0	6.0	5.0
2	Dissatisfied	4.0	30.0	17.0
3	Neither Satisfied nor Dissatisfied	30.0	42.0	36.0
4	Satisfied	62.0	22.0	42.0
5	Highly Satisfied	0	0	0
9	Missing Value	0	0	0
	Total	100.0	100.0	100.0

Table 4: Attitude toward number of outlets

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Highly Dissatisfied	2.0	0	1.0
2	Dissatisfied	18.0	36.0	27.0
3	Neither Satisfied nor Dissatisfied	38.0	18.0	28.0
4	Satisfied	42.0	40.0	41.0
5	Highly Satisfied	0.0	6.0	3.0
9	Missing Value	0	0	0
	Total	100.0	100.0	100.0

Table 5: Attitude toward working hour of outlets

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Extremely inconvenient	8.0	0	4.0
2	Inconvenient	24.0	18.0	21.0
3	Neither Convenient nor Inconvenient	40.0	64.0	52.0
4	Convenient	26.0	18.0	22.0
5	Extremely convenient	2.0	0	1.0
9	Missing Value	0	0	0
	Total	100.0	100.0	100.0

Table 6: Overall satisfaction to subscribed billing system

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Highly Dissatisfied	4.0	8.0	6.0
2	Dissatisfied	2.0	4.0	3.0
3	Neither Satisfied nor Dissatisfied	8.0	20.0	14.0
4	Satisfied	82.0	64.0	73.0
5	Highly Satisfied	4.0	4.0	4.0
9	Missing Value	0	0	0
	Total	100.0	100.0	100.0

Table 7: Satisfaction level with existing billing system compared to previously subscribed system

Response Value	Response Category	% Observed in Total
1	I am highly satisfied	6.0
2	Prepaid electricity is better	3.0
3	I was better with post paid	14.0
4	I am extremely dissatisfied	73.0
5	I am highly satisfied	4.0
	Total	100.0

Table 8: Intention to switch back to the previously subscribed system

Response Value	Response Category	% Observed in Pre-Paid	% Observed in Post-Paid	% Observed in Total
1	Yes	12.5	100.0	22.2
2	No	87.5	0	77.8
	Total	100	100.0	100.0

Table 9: Mann-Whitney Test

	Level of convenience in paying for cards / bills through respective payment methods	Attitude towards the process of recharging cards / charges taken in 'Bills Pay' outlets	Attitude toward working hour of outlets	Attitude toward number of outlets	Overall satisfaction to subscribed billing system	
Mann-Whitney U	1094.500	669.000	1195.500	1214.500	1037.000	
Wilcoxon W	2369.500	1944.000	2470.500	2489.500	2312.000	
Z	-1.155	-4.284	-.410	-.259	-1.883	
Asymp. Sig. (2-tailed)	.248	.000	.682	.795	.060	

a. Grouping Variable: Billing System

Table 10: Two-Sample Kolmogorov-Smirnov Test

		Level of convenience in paying for cards / bills through respective payment methods	Attitude towards the process of recharging cards / charges taken in 'Bills Pay' outlets	Attitude toward working hour of outlets	Attitude toward number of outlets	Overall satisfaction to subscribed billing system
Most Extreme Differences	Absolute	.220	.400	.140	.160	.180
	Positive	.060	.000	.140	.060	.000
	Negative	-.220	-.400	-.100	-.160	-.180
Kolmogorov-Smirnov Z		1.100	2.000	.700	.800	.900
Asymp. Sig. (2-tailed)		.178	.001	.711	.544	.393

a. Grouping Variable: Billing System

Table 11(a): Overall satisfaction to subscribed billing system – Billing System Cross-tabulation

Description		Billing System		Total	
		Pre-Paid	Post-Paid		
Overall satisfaction to subscribed billing system	Highly Dissatisfied	Count	2	4	6
		% within Overall satisfaction to subscribed billing system	33.3%	66.7%	100.0%
		% within Billing System	4.0%	8.0%	6.0%
	% of Total	2.0%	4.0%	6.0%	
	Dissatisfied	Count	1	2	3
		% within Overall satisfaction to subscribed billing system	33.3%	66.7%	100.0%
		% within Billing System	2.0%	4.0%	3.0%
	% of Total	1.0%	2.0%	3.0%	
	Neither Satisfied not Dissatisfied	Count	4	10	14
		% within Overall satisfaction to subscribed billing system	28.6%	71.4%	100.0%
		% within Billing System	8.0%	20.0%	14.0%
	% of Total	4.0%	10.0%	14.0%	
	Satisfied	Count	41	32	73
		% within Overall satisfaction to subscribed billing system	56.2%	43.8%	100.0%
		% within Billing System	82.0%	64.0%	73.0%
	% of Total	41.0%	32.0%	73.0%	
Highly satisfied	Count	2	2	4	
	% within Overall satisfaction to subscribed billing system	50.0%	50.0%	100.0%	
	% within Billing System	4.0%	4.0%	4.0%	
% of Total	2.0%	2.0%	4.0%		
Total	Count	50	50	100	
	% within Overall satisfaction to subscribed billing system	50.0%	50.0%	100.0%	
	% within Billing System	100.0%	100.0%	100.0%	
	% of Total	50.0%	50.0%	100.0%	

Table 11(b): Chi-Square test of relationship between type of billing system and overall satisfaction

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.681	4	.322
Likelihood Ratio	4.788	4	.310
Linear-by-Linear Association	0.211	1	.102
Number of Valid Cases	100		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.50.

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