Perception of the Use of Pre-paid Electricity Meters in Chidzidzi, Mutoko, Zimbabwe

T. Makonese, S. Mufukare, and S. von Solms

Abstract— Since the era of the economic adjustment program, the Zimbabwe Electricity Supply Authority (ZESA) Holdings has been faced with an increasing problem of non-payment of electricity service charges, especially in the medium- to low-income households. In the early 2000s, the power utility company resorted to disconnections and the removal of post-paid electricity meters for non-paying households. Many customers accused ZESA Holdings of overcharging them on their monthly bills through the post-payment plan. As a way of recovering costs from non-paying households, ZESA Holdings resorted to the deployment of prepaid electricity meters, which automatically disconnect when households pre-coded electricity tokens are used up. The objective of this study is to understand consumers' perception of the use of prepaid electricity meters versus the post-paid system, in Chidzidzi, Mutoko, Zimbabwe. Lessons learnt from this study are useful for informing policy in the country and other developing countries.

***Index Terms*— public perception; electricity, pre-paid meters, policy, Zimbabwe**

1 Introduction

In most developed countries a common way of paying for electricity services is through the post-payment plan in which a customer is billed after a month for the units of electricity used in that period. According to Tewari and Shah [1], the cost of metering, billing and revenue collection increases if the services are provided to large numbers of small and dispersed customers. In some developing countries, high electricity costs are a strong impetus for customers to resort to pilfering electricity or to temper with meter readings. The pilfering of electricity leads to huge losses in revenue by power utility companies and, in some cases, the loss of lives because of illegal connections and power theft [2]-[4].

Zimbabwe is a developing county in southern Africa that is currently facing a politico-economic crisis. As a result, the power sector has been starved of investments; there is currently an inadequate flow of revenue within the utility to finance new investments [5]. The country generates about 1400 MW of electricity against a peak demand of 2000 MW. The government and the utility company have recognised their inability to provide electricity services to all corners of Zimbabwe. They have opened up the power sector to private investors or independent power producers (IPPs) [6]. In the early 1990s, the operational performance of the parastatal was hampered by the drought leading to power shortages across the country. To turn around the many challenges facing the utility (over-staffing, operational inefficiencies), the Government instituted a performance improvement programme (PIP) aimed at improving the operational performance of ZESA in finance, customer service, generation, transmission, and distribution [5]. A significant achievement of the PIP was that operational functions of the utility were improved. However, in the late 1990s the operational improvements that were realised when the PIP was promulgated declined due to system losses, which stood at 11% [5]. On the other hand, in 1997, the Zimbabwean dollar started depreciating against major currencies. Because ZESA Holdings' imports are forex related, the utility was exposed to the fluctuations in foreign exchange and was not well equipped to handle the risk of that magnitude. The utility began to operate at a loss as the tariff had been seriously eroded, implying that the poor and the rich enjoyed the same level of subsidy [5].

Since the era of the economic adjustment program, the Zimbabwe Electricity Supply Authority (ZESA) Holdings has been faced with an increasing problem of non-payment of electricity service charges, especially in the medium- to low-income households. Consequently, the financial and operational performance of ZESA Holdings deteriorated over time [5]. In light of this, in the early 2000s, the power utility company resorted to disconnections and the removal of post-payment electricity meters for non-paying households. The removal of meters proved to be a futile exercise, and the utility company resorted to the deployment of prepaid electricity meters, which automatically disconnect when households' pre-coded electricity tokens are used up, as a way of recovering costs from non-paying households. The utility company was concerned about creating public values including *payment morality* (citizens are morally obligated to pay for services rendered), *rehabilitating* (restore payment morality in defaulting citizens) and drawing the poor into its administrative net [7].

In Zimbabwe, electricity consumers can be grouped into two categories: those with prepaid meters and those on a post-paid system. Currently, efforts are underway to introduce prepaid meters in all electrified households. Such energy policies were put in place to alter electricity consumption behaviour in targeted communities with the aim of discouraging wastages and encouraging the efficient and sustainable use of electricity [8]. Energy efficiency in

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households is a function of user behaviour among other factors [9].

Households on post-paid meters and those that are unmetered tend not to use electricity sparingly. For example, most households on the post-payment plan in Zimbabwe do not switch off electric gadgets even when they are not using them. It is not surprising to find light bulbs that are left switched on during the day, with TVs and radios left operating without anyone being entertained by them. The behaviour of consumers on prepaid meters is likely to be different as they are mindful of their consumption patterns [8].

The use of post-paid meters has faced resistance from some consumers, many of whom have accused ZESA of overcharging them on their monthly bills. This is because the readings of post-paid meters are not collected on a regular basis. As such, average consumption rates are estimated for households without actual monthly electricity consumption records. Arawomo [8] was of the opinion that the distributors are lazy to collect readings on a monthly basis. However, it should also be noted that some households place their meters far from the reach of the utility's workers, with some not opening their gates to these workers for fear of theft (there have been reported incidences of theft where the thieves masqueraded as ZESA workers).

This paper aims to analyse public perception of the use of pre-paid electricity meters in Chidzidzi, Mutoko, Zimbabwe. Structured questionnaires were employed, and 100 households were interviewed. Energy use behaviour concerning washing, ironing, cooking, heating and lighting were not considered in this study.

2 Materials and Methodology

2.1 Case study area

The study was undertaken in Chidzidzi, a suburban area in Mutoko town, which is situated in the Mashonaland East Province of Zimbabwe and is the capital of Mutoko district. The town is situated about 145 km from the city of Harare and is inhabited by the *Buja* people. Mutoko was established in 1911 as an administrative station.

Results presented herein are from the data collected only for the Chidzidzi residential area in Mutoko. Chidzidzi has about 200 households, 80% of which are electrified. No effort was made to collect data from other townships and villages in and around Mutoko. Questionnaires were used as the main tool for data collection with both open-ended and close-ended questions being employed. One hundred households were surveyed for purposes of this study using random sampling techniques. The research instrument was pre-tested in a pilot study before the field survey on ten households, for quality control purposes.

An informed consent form was included at the start of each questionnaire, which respondents had to sign after the researchers explained the purpose of the survey and before the interview commenced [10]. Little personal information was requested from the interviewees, and as such, the researcher was advised that formal ethical clearance was not required.

3 Results And Discussion

3.1 Socio-economic variables

Results show that of the interviewed households, 57% were property owners while 43% were tenants. About 7% had been residing in the Chidzidzi area in the past 1-2 years, while 14% had been staying in the area for the past 3-4 years; 79% had lived in the area for over five years. The gender distribution was balanced; 50% of the respondents were female, with the male respondents making up the difference. This finding is purely coincidental as the surveys were carried out over the weekend when the majority of the respondents were home. This result might imply that no single gender type uses more prepaid electricity compared to the other. The ages of those interviewed ranged from 27 years to 60 years, with 57% above the age of 40 years, 21% (below 30 years), and 22% in the 30 – 40 years category. A majority (79%) of those interviewed had a tertiary qualification (university and college), while 21% had a secondary qualification. The income distribution of the respondents showed that the majority (83%) earn less than USD 600 per month, 12% between USD 600 to USD 1000 per month, with only 5% earning above USD 1000 per month.

3.2 Use of prepaid meters

All houses in Chidzidzi have prepaid meters installed except those that are currently under construction. The duration of using the service varies between households. From the surveys, it was found that no households were using the technology for less than a year since its installation. The majority of respondents had been using the technology for 5 – 6 years since the prepaid meters were rolled out in the area. Those who have been using prepaid meters for the past three years, stay in newly built houses. Table 1 contains a summary of the duration of using prepaid electricity metres by the Chidzidzi residents.

Table 1: Duration of using prepaid electricity meters

Duration	Users	Percentage Use
< 1 year	0	0
1 – 2 years	10	7
3 – 4 years	24	14
5 – 6 years	66	79
Total	**100**	**100**

3.3 Perception of prepaid meters

The perception end-users have on a product will influence their decision to continue or discontinue using the product. However, there were mixed feelings about the acceptability of the technology in the area. The majority of respondents indicated that the technology was a welcome relief, although they were initially sceptical about its benefits. All the respondents noted that the advent of prepaid electricity meters resulted in fewer blackouts. When asked about the benefits of using prepaid electricity meters, a male householder mentioned that:

> "*Prepaid electricity meters are a most welcome relief in the area. Initially, people were apprehensive about the potential of the technology. We had heard that prepaid electricity was much more expensive than*

electricity from a post-payment system. I have realised that this new system is cheaper than the old system. Since the introduction of prepaid meters, we hardly experience load shedding. Before this new system, we experienced load shedding every day of the week between 9 am and 10 pm."

O' Sullivan *et al*. [2] contended that prepaid meters could be a useful tool to collect electricity debts while continuing the supply of electricity. On the other hand, retailers and consumers often perceive them as a form of budgetary tool. Results in this study reveal that consumers perceive prepaid a cheaper option compare to the post-payment plan. This could hold true for Zimbabwe but cannot be entirely true for all countries as some prepayment systems are more expensive than single tariffs. A study carried out in Dunedin, New Zealand showed that pre-paid electricity was much more expensive compared to the single tariff rates, with a 23% increment for a controlled hot water plan and 39% increase in price for an uncontrolled hot water plan [2]. However, for the Zimbabwean situation, prepayment looks cheaper due to the model the power utility company has been employing to collect revenue previously– consumers were billed on estimates rather than actual meter readings.

A homeowner, who has tenants renting his backyard cottage, lauded the introduction of prepaid electricity meters. The respondent had lamented financial losses through unpaid electricity bills when using the post-payment system, especially when tenants decide to vacate the property without giving prior notice. The introduction of prepaid electricity meters has helped in curbing this problem. This sentiment was echoed by 80% of homeowners who are renting out their properties.

"*The introduction of prepaid meters has helped us curb non-payment of electricity bills by some tenants. Now tenants only use the electricity that they have purchased. With the old system, tenants left us with huge electricity bills to settle, especially when they vacate the property without giving us adequate notice. Now they use what they pay for- problem solved!*" a male respondent.

Tenants indicated that, on average, they now pay less towards electricity compared to the post-payment era. Others accused homeowners of ripping them off in the post-payment era, as the electricity bill was divided equally between families and not according to use.

"*Prepaid electricity meters encourage us to save. Budgeting for electricity is now easy, and we now have limited load shedding periods per week. I am happy with this development since I now pay less towards electricity. The property owner used to rip me off during the post-payment era, as the electricity bill was divided equally between families and not according to consumption patterns. Even during the month when I spend less time at home, my electricity bill would always come exorbitantly high*" a tenant

Residents see a possible benefit vis-à-vis saving on electricity, as they are now able to regulate their energy consumption and only buy what they need at a time. Similar to findings reported in Quayson-Dadzie [11], results presented herein show that field officers from the utility would no longer harass them and threaten them with disconnections of power supply due to the inability to settle the electricity bills on time.

Although the community accepted the prepaid electricity meters, the respondents all felt the technology was 'forced down' on them, as the community was not consulted before installation. The community felt alienated in both the planning and the implementation of this programme.

"*The technology was forced on us. We were not consulted, and the electricity utility company should be relieved that the system has been accepted thus far. Otherwise, it would have been chaotic. You cannot come into someone's home and demand him or her to change their way of life without having consulted with them. At least those who did not owe the utility should have been given an option to choose between the two options than to criminalise everyone and take away our right to choose.*"

3.4 **Challenges with prepaid electricity meters**

The study further found that the community faces challenges when using prepaid electricity meters. The first relates to the purchasing of pre-coded electricity tokens. Of the interviewed households, 71% indicated they had difficulties in accessing the tokens from vendors, either because the tokens were not available or due to network problems.

"*Most people wait until they are running out of electricity to look for pre-coded electricity tokens. Some do not know yet how to read the meter and to estimate when they are likely to run out of credit. It is always advisable to buy more than you need in case there are issues with the vendors and the tokens are not accessible. You have to look for the tokens way before your electricity runs out*".

These sentiments were echoed in findings presented in Quayson-Dadzie [11], who found that most prepaid electricity customers in Accra, Ghana could not read the energy consumed and failed to estimate when they are likely to run out of units.

Some households (14%) indicated that they had problems with the prepaid systems a few days after they were installed, and it took about 48 hrs to have the technical glitches resolved. The majority (86%) of the respondents indicated that they did not experience any technical glitches with the technology since it was installed. They went on to reaffirm that the prepaid meters are of good quality otherwise they would not have lasted. Asked whether they would prefer reverting to the post-payment system, given the challenges noted above, all the respondents stressed that they preferred pre-paid electric meters instead. This is contrary to findings reported in Quayson-Dadzie [11] that in Accra, once faced with challenges of poor quality meters and defaced prepaid cards, consumers were more than willing to revert to the post-payment system. Mathenge [12] was of the opinion that the majority of pre-paid electricity consumers in Kenya were more than willing to revert to the post-paid system citing poor quality services since migrating to the new system.

3.5 **Government support of prepaid systems**

In supporting the installation of prepaid meters and ensuring that the technology is readily adopted, the utility company ensured that the consumers incurred no costs during the installation phase. However, the initial capital for the installation of pre-paid meters will be recovered over a period by deducting a small fee from tokens purchased. Concerning the conventional post-payment system, the consumers pay a high installation cost (for poles, transformers, and network lines) and will continue to pay a fixed monthly amount over and above the actual energy consumed. This ensures that the charge per unit of electricity is low in post-payment systems compared to pre-payment systems. However, the pre-payment has the added advantage of allowing consumers to budget their electricity usage and save electricity – prepaid electricity meters provide a continuous display of how much electricity is left. The flashing lights indicate how quick you are using electricity and a bright red flashing light signals that the available electricity is critically low and the system needs to be recharged.

> "*They decided to install prepaid electricity meters without us funding for the exercise. If we had been required to pay for installation, I do not think any of us would have adopted the system. Before the introduction of pre-paid meters, we had paid huge amounts of money just to be connected to the grid. Incurring another cost, for a technology we did not request, would have caused a huge financial burden on our pockets.*"

Of the interviewed households, 36% indicated that they owed the power utility company for electricity consumed during the post-payment plan, while 64% migrated to the pre-payment plan debt free. The power utility company has ensured a smooth transition to prepaid systems by allowing owing consumers to spread the debt onto the new system until it is paid off. Currently, the utility takes 40% from every transaction made on the prepaid system until the debt is settled.

"*On average they deduct about USD 2 from every transaction I make. The money is deducted from the tokens. They say the system keeps track of the accounts and once the debt is fully paid, the system will then stop deducting and once would get a full dollar's worth of electricity.*"

Scholars in other parts of the world have supported this model. For example, Boardman and Fawcett [13] were of the opinion that prepayment systems are ideal for households with huge electricity debts. Prepayment system allows consumers with debts that have built on the account before migrating to prepaid meters, to pay off the debt while continuing to access electricity services.

3.6 **Implications of findings**

The value of prepaid electricity meters is often overlooked. Consumers tend to develop an increased awareness of energy usage. According to Faruqui *et al*. [14], households who have in-home displays in conjunction with prepaid meters reduced electricity consumption by 14% compared to households on a post-payment plan. O'Sullivan *et al*. [2] were of the opinion that prepaid electricity meters provide greater budgetary control thereby avoiding the accrual of debt. Customers on a prepayment plan are less likely to experience disconnections and reconnection fees, which are applied to customers on a post-payment plan. However, the technology has to be durable, and maintenance services should be easily and readily accessible. The standards association of Zimbabwe (SAZ) need to work with independent laboratories to test the quality and durability of samples of pre-paid meters to ensure they meet the standards. This is needed to prevent major defects, which would lead to the meters being recalled after installation thereby inconveniencing the user.

Public participation and education are important in ensuring the adoption, acceptability and continued use of the technology [11],[12]. In future, the government and ZESA Holdings should carry out public awareness campaigns to get buy-in from the targeted users. The majority of respondents felt that the technology was forced on them without prior consultation. In other countries where prepaid electricity meters have been readily accepted such as Kenya and Ghana, the responsible authorities embarked on public awareness and education campaign before rolling out the technology. In Ghana, four different sets of flyers were used with each flyer highlighting the importance of switching from the post-payment plan to pre-paid electricity meters [11]. Again, mass media such as TVs and radios were made use of in Kenya [12] to convince consumers of the importance of pre-paid meters. Mathenge [12] contended that service provider did not use mass media effectively to sensitise customers on the benefits of the new technology. Other important channels that can be used to disseminate information on the benefits of using pre-paid meters include public announcements, introducing smart metering and pre-paid system in the education curriculum, and the involvement of community champions in the energy efficiency conversation. It is imperative to involve every member of the community in the public education campaigns.

There is a need to increase vending points in communities where pre-paid electricity meters are in use. The study found that most households complained that the pre-paid recharge tokens were not easily accessible. Some had to travel long distances to purchase the tokens. In some instances, the vending points were offline such that the pre-paid users could not purchase the tokens when they needed them. This problem could be averted if the sale of the tokens is decentralised with the responsible authorities sub-letting the sales to private entrepreneurs [11].

ZESA Holdings provided the initial capital for the installation of pre-paid meters in Chidzidzi. Consumers were not obliged to purchase the technology and to provide funds for the installation of the technology. The study found that the utility company would recover the cost of installation by deducting a fee from the tokens purchased until the debt is paid off. Some consumers might see this as a rip off as they covered the initial capital for the installation of post-paid systems. The strategy to spread the debt over time can be seen to benefit only new houses that were not initially connected to the post-payment system. In Ghana, free installations were encouraged to lure customers from post-paid systems to pre-paid systems. The management put in place policies that ensure all service delivery companies

adhered to free pre-paid meter installations [11]. As a policy strategy, the government of Zimbabwe could learn from experiences elsewhere and should consider free pre-paid meter installations without the customers or households having to pay for the initial cost albeit over an extended period.

4 Conclusion

The value of public participation in energy efficiency programmes such as the installation of pre-paid electricity meters is often ignored or underestimated. The paper examined public perception of the use of prepaid electricity meter in Chidzidzi, Mutoko, Zimbabwe. Results showed that even though the technology was forced on them without prior consultation, the majority of the respondents thought that the new system was better than the conventional post-paid system. However, they noted some challenges such as lack of maintenance services, lack of vendors and accessing the tokens. These results have implications on future pre-paid electricity installation campaigns in the country. The government and service providers should ensure that the public is involved in consultations before the technology being rolled out. Again, there is need to engage in educational campaigns, install the technology free of charge, increase vending points once the technology has been adopted and provide fast response maintenance services.

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