1.0 INTRODUCTION

A reliable and cost effective electricity service is critical to economic growth. In order for ZESCO to satisfy the electricity demands of its current customers and bring its services to the new customers, it is essential to ensure an adequate revenue stream to cover its operations and maintenance costs and a portion for new investments in system rehabilitation and expansion.

For this to be achieved it is necessary for ZESCO to operate efficiently and economically. In addition to having identified prepayment as one of the six strategies to reduce distribution non-technical losses it has been identified as a vital tool for revenue enhancement.

ZESCO Limited has in the past undertaken various schemes to improve the debt situation i.e. through debt dismantling campaigns and disconnections, yet the customer debt has continued to rise. It is for this reason that ZESCO decided to undertake the prepayment pilot project to determine the benefits of the prepayment system in terms of revenue collection, cash flow enhancement and customer relations. Emmasdale Township in Lusaka was selected as a pilot area.

Emmasdale Township is a medium cost residential area and has a total of 1,800 customers and the project targeted only 1000 customers within the area.

The marketing of the prepayment system through the public media, posters and door-to-door campaign was undertaken one month before the installation of the prepayment meters commenced. The benefits of the prepayment system were also explained to the customers through the use of brochures and regular meetings.

2.0 EXPERIENCE

2.1 Tariffs and incentives

In order to entice customers to change from the conventional metering system to the prepayment system, the following incentives were provided:

- 300kwh free units upon connection
- 5% discount for electricity purchased
- No monthly service charge.

The same stepped tariff for residential customers on the credit system was also applied for the prepayment system. The exception on the prepayment system was that the stepped tariff was extended over a period of 12 months. The residential customers were charged K60(US$1.25c) for the first 3600kwh, K85(US$1.77) for consumption above 3600kwh but below 8400kwh, and K140(US$3) for consumption above 8400kwh within a period of 12 months. The exchange rate is 1US$ = ZMK4800.

2.3 Implementation

The pilot Prepayment metering project was started in Lusaka’s Emmasdale township. 1000 single phase key pad prepayment meters, 3 vending machines and 01 System master station (SMS) were acquired. A number of modems were also acquired to facilitate communication between the vending machines and the SMS. The pilot scheme in Emmasdale Township was implemented by ZESCO in order to establish whether the system was cost effective and could address problems like fraud, theft of electricity and revenue collection difficulties experienced when using the conventional credit metering system.

Below is the illustration showing the structure of the Emmasdale prepayment system in Lusaka.
DATA TRANSFER WAS BY FLOPPY DISKETTES AT END OF BUSINESS DAY

**Figure 1:** Emmasdale prepayment metering system

The implementation of the prepayment system started on 2\textsuperscript{nd} December 2002 with the first two (02) weeks dedicated to marketing and a customer awareness campaign. Meter installation started on 15\textsuperscript{th} December 2002 and the first prepayment meter was commissioned on 19\textsuperscript{th} January 2003. The vending stations were installed at Chaisa, Malambo and Kariba House and the Station Master System was placed at the Elyo Lysa offices. In the initial stage 1000 meters were installed out of which 90 failed. Towards the end of 2003 another 85 meters failed. Failures ranged from defective LCD displays, circuit breaker not tripping, meter not accepting transaction and meter giving negative balance. This gives a failure rate to 17.5%.

By 31\textsuperscript{st} March 2004 a total of 911 meters were commissioned. The meter installation exercise was segmented into two (02) parts namely, meter installation and meter commissioning. Before commissioning of a meter, the team had to verify and reconcile the account from the credit system. Thereafter a team of meter readers were deployed to train customers on the how to operate a prepayment meter and educate them on the efficient use of electricity energy. The connected customers comprised 92% residential, 7% commercial and 1% social tariff (e.g. schools, churches).

### 2.4 Results

A comparison was made between the conventional credit system and prepayment system in terms of revenue collection and debt management and the results are shown in figures 1, 2, 3 and 4.

#### 2.4.1 Revenue Collection On the Credit System

![Figure 1: Amount Billed Against Revenue Collection Using Credit System](image)

![Figure 2: Customer Arrears in Emmasdale Township](image)
profile of customer debt in the whole Emmasdale Township for the period April 2002 to October 2002. The collections had improved whenever there were certain interventions like mass disconnections to collect revenue in the area.

2.4.2 Revenue Collection On the Prepayment System

Within the area, there are three vending points namely Chaisa, Malambo, and Kariba House. The graphics showing the monthly revenue collections per vending point and management of customer debt on the prepayment system are in figures 3 and 4 below:

![Graph of Monthly Collections Per Centre](image)

**Figure 3: Revenue Collection on the Prepayment System**

The prepayment system was effective in managing the customer debt. Of the three paying points (Malambo, Chaisa and Kariba House) the sales were high at Chaisa Centre because it is centrally located and convenient to customers in the pilot area. As is evidenced from the figure 4, the debt has shown a downward trend from the inception of the prepayment project.

![Graph of Customer Debt Management](image)

**Figure 4: Customer Debt on the Prepayment System.**

The debt was factored as a proportion of the tariff that the customers were expected to pay. It is expected that the debt will be completely reduced within a period of four years.

2.4.3 Other results

After the installation of the prepayment system, the average monthly energy consumption per household dropped by 20% from 750kwh with the conventional credit metering system to 600kwh.

As mentioned earlier, the failure rate for the single-phase prepayment meters has been rather high mainly due to the poor quality meter and in few cases due to power supply problems. The following are the statistics for the faults on the single-phase prepayment meters:

- Breaker Tripping Fault: 152
- Breaker not Tripping: 16
- LCD (display) Fault: 8
- Incorrect credit: 8

The customers’ perception on the usage and the value of electricity energy has changed with the introduction of the prepayment system. Customers are in control of the usage and they demand a better service from ZESCO since they pay upfront.

So far 6 cases of meter tampering have been identified and the offenders have been penalized.
3.0 THE WAY FORWARD

ZESCO is currently implementing the distribution loss reduction project. This was after it was recognized that there was a need for a concerted and coordinated effort to bring about further loss reductions. The Loss Reduction Project commenced in January 2003 and the six strategies listed below are being implemented. This project is complementary to several previous efforts that were conducted to reduce Distribution losses.

The strategies are:

- Meter all Bulk Power Supply Purchases and Sales
- Meter all new and unmetered customers
- Implement Prepayment Metering Systems
- Improve Customer Information System
- Eliminate theft of Electricity
- Basic Training for frontline staff

Implementation of the various strategies is yielding results as can be seen in the graphs below. Between January 2003 and November 2004 the overall trend has been a reduction.

Extreme cold experienced in May and June 2003 contributed to high losses simply because the demand went up while only a few meters were installed during the period. A lot of the domestic customers remain unmetered and are billed on estimated quantities. Their consumption goes up in the cold season but they are reflected as consuming the same quantity of energy. The increased consumption is captured by the readings that are taken at the bulk supply points. It is of interest to note that the losses in May and June 2004 were not as high because the project had already addressed some of the problems of non metered customers.

Currently the total purchases against sales show that the gap is reducing an indication that ZESCO is capturing new information on new and existing customers and that the SIX strategies being followed are bearing fruit.

Losses have moved from a maximum recorded figure of 29% in July 2002 to a minimum of 18% in January 2004. In November 2004, the figure was 18.19%.

The target figure for the Distribution losses is about 10%.

With the experience that has been gained from the Emmasdale pilot, the prepayment project is to be extended to other areas targeting mainly the good customers in the low density areas.

A 20% drop in energy consumption in Emmasdale project is an indication that customers can control the usage of electricity energy. A prepayment meter had features that help the customer monitor and control usage of electricity. In addition, all the prepayment meters have been installed inside the houses and are easily accessible by customers. In addition, the reduction of energy consumption reduction is also advantageous for ZESCO Limited because the investments in the distribution system can be deferred and funds meant for the same used in the needful areas.

The prepayment system is a very convenient tool for revenue collection and debt management and has the following advantages:

- No cost for meter reading, billing and bill delivery. Customers on the prepayment system do not pay the monthly service charge to cover the cost of processing the bill and bill delivery.
- No cost for disconnection or reconnection.
- Effective management of Customer Debt - The prepayment system has an embedded debt management system to manage arrears.
- Collection of revenue upfront before delivery of service.

It was observed that most customers preferred to buy their top-up tokens from Chaisa Centre, which was centrally and conveniently located for customers in the pilot area.

There is need to enhance regular audits and enforce stiffer penalties to curb meter tampering. Statistical meters have been installed at the distribution transformer stations for energy balances to monitor distribution losses and to detect fraud.

The high failure rate of the single-phase
The prepayment meters were attributed mainly to poor quality of the single-phase meters. This problem was compounded by poor after sales service and had impacted badly on the implementation of the prepayment system. It is expected that future supplies of prepayment meters will fall within the acceptable failure rates base on the industry norms.

To successfully manage and sustain the prepayment system training of staff managing the system has been identified as very critical.

A review of the tariff structure for the customers on the prepayment system is underway. It has been recognised that a flat tariff would be more convenient than a stepped tariff for customers on the prepayment system.

Plans are underway to install another 20,000 prepayment meters, 02 System Master Stations and 10 Vending machines over the next three months. A further 30,000 prepayment meters will be installed over six months after the initial three months period.

4.0 Conclusion

The implementation of the prepayment system in Emmasdale has been a success because both the customers and ZESCO project staff have accepted the system as a modern and cost-effective tool to address the billing and cash flow problems associated with the conventional credit metering system. Generally, the response from the customers has been overwhelming and customers have recognised that the prepayment system has numerous advantages and gives them control over the usage for electricity energy.

The prepayment system also provides reliable measurement (no assessments), improvement in cash flow, reduces distribution losses and eliminates debt related to credit meters. Other benefits include improved customer service and reduction in customer energy consumption as the customer is in control of energy usage. The prepayment system will help ZESCO achieve its goals through a more efficient revenue collection and improved cash flow.

The major problems during the implementation of the prepayment system were the high failure rate of single-phase meters coupled with poor after sale service. The stepped tariff used for the residential customers on the prepayment system is under review and a flat tariff is preferred.

ZESCO has identified the implementation of the prepayment meter as a measure to improve revenue collection as well as to reduce on distribution losses. The implementation will represent a major policy shift for ZESCO as there are plans to make sure that all new domestic customers are metered via the prepayment method.