

Evaluation of Prepaid Metering Scheme: Boost to Utility's Revenue

Sandhya Sundararagavan



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Executive Summary

Poor revenue realisation from temporary connection (LT7) consumers has been adversely affecting the revenue stream of Bangalore Electricity Supply Company Limited (BESCOM). The KERC Tariff Order dated 30.04.2012 required that all LT7 consumers be assigned a prepaid meter duly observing the provisions of Clause 12 of the Conditions of Supply of Electricity of the Distribution Licensees in the State of Karnataka. Hence, BESCOM introduced prepaid meters (using smart card technology) to LT7 consumers on a pilot basis in the Indiranagar division. A total of 3,525 meters were installed in this pilot project. This paper presents an evaluation of the pilot scheme in terms of financial viability, along with its impact from both utility's and consumers' perspectives. This study evaluates the possibility of scaling up the scheme for select consumer categories in the distribution utility.

1. Introduction

With rapid economic progress and increasing population, distribution utilities are witnessing a rising trend in the energy consumption level of consumers. Bangalore Electricity Supply Company Ltd. (BESCOM) consumed 24,436 MUs in 2015 (4.5% higher than 2014) (KERC, 2015) (KERC, 2016), which was the highest in the state of Karnataka when compared with other distribution utilities. Power consumption is expected to only increase with time. Therefore, metering plays a central role in recording accurate consumption data of consumers. Prepaid metering scheme is one such mechanism that not only helps a utility in monitoring electricity usage, thefts, breach of sanctioned load, etc., but also streamlines the collection of revenues for the utility.

The current scheme of revenue collection in the utility is labour-intensive, which primarily involves manual reading of meters and distribution of bills to consumers at their premises. Not only does the current metering scheme add to the cost incurred by the utility, it also results in typographical errors. It was found that BESCOM has around 75,000 temporary connection (LT7) consumers from whom revenue realisation was not satisfactory. Some of these consumers even deferred payments on a regular basis, which was adversely affecting BESCOM's revenue stream. Historically, it has been observed that while some consumers use more power than expected by exceeding their sanctioned loads, others indulge in malpractices like thefts and tampering of meters. Such unpredictable consumption due to malpractices has led to significant revenue losses for the utility (based on discussions with utility authorities).

Prepaid metering is expected to decrease the cost of reading the meters and also of disconnection and reconnection costs as utilities receive payments prior to consumption in this scheme. Given the provision of disconnecting service (if the voltage exceeds the limits, and reconnecting when the voltage is back within the normal limits), there is a scope for improvement in the collection efficiency. Further, display units enable consumers to monitor the units being consumed in real time, thereby allowing them to optimise their consumption.

This paper presents the perceived benefits of implementing prepaid meters for temporary connections on a pilot basis in Indiranagar division, Bengaluru. The analyses presented in this

paper intend to highlight how prepaid meters would improve the collection efficiency from consumers with temporary connections. Through this pilot scheme, BESCO made significant earnings from a representative sample set of consumers. The study suggests that BESCO earned 100% revenue due to the imposition of penalty charges on consumers who exceeded their sanctioned load limits. Further, a questionnaire-based survey was conducted across different types of temporary connection consumers to gather perceptions and awareness level with respect to the scheme. While the prepaid scheme is fairly matured globally and in some parts of the country, a well-structured implementation plan for installing a prepaid metering scheme in alignment with the national target of installing smart meters could pave the way for reduction of losses and thefts. In doing so, it is important to pay attention to spreading awareness about the benefit of the scheme so that there is uptake by the consumers.

2. Literature Review

Prepaid metering has been widely adopted by many countries. Prepaid schemes for gas and water supply were introduced for the first time in South Africa in the late 1980s, but are now popular in other countries (such as the UK and Turkey) as well. In South Africa, the prepaid mechanism was initially developed with the objective of supplying power to a large number of low-income and geographically dispersed users. In several other countries like the US and Mexico, prepaid meters required consumers to apply for credit in advance (before using power). This practice was introduced to enable utilities to reduce operating costs and continue offering services to consumers with irregular income streams. This mechanism of billing was well received by consumers, as it helped them plan their household expenditure. Further, it limited the possibilities of receiving unexpectedly high monthly bills. Based on findings of behavioural studies conducted in the above-mentioned countries, consumers using prepaid meters planned their energy usage more efficiently than before (O'Sullivan, 2014).

The United Kingdom has always been the pioneer in prepaid meter implementation—from initiating token-based prepaid electricity meters in the early 1890s to smart prepaid meters. The country has been innovating and customising prepaid technology over several years based on market analytics. In the recent past, the utilities have also come up with a process through which prepaid consumers can switch between service providers.

In India, prepaid metering implementation pilots were initiated in West Bengal State Electricity Distribution Company Ltd. and Maharashtra State Electricity Distribution Company (MSEDCL).

In West Bengal, the West Bengal Electricity Regulatory Commission (WBERC) has been the driving force behind the implementation of prepaid metering scheme. WBERC made it compulsory for new temporary connections to be registered under this scheme. Before this scheme, it was harder to monitor payments from temporary connections; also, with erratic consumption patterns of temporary connections, it was harder for the utility to forecast future demands. In order to meet the requirements of these consumers, the state utility had to purchase power on a short-term basis. By implementing this scheme, these consumers essentially paid for their power in advance, thereby helping the utility to plan better for future requirements.

In Maharashtra, MSEDCL deployed meters for Low Tension (LT) domestic consumers. Payment of monthly bills from these premises was found to be cumbersome to monitor. MSEDCL

consumers were asked to undergo training sessions for using prepaid meters, and were provided information via print media for raising their awareness about the scheme and its benefits.

Keeping in view some of the key initiatives in prepaid metering, prepaid technology has been successful in tackling issues of high operational costs and clearing outstanding debt, and at the same time has been accepted by the customer base. However, the biggest drawback faced by the utility is the prohibitive costs of the meters. Due to lack of competition in the market, the existing manufacturers are providing the meters at a significantly higher cost in comparison to the conventional meters. If prepaid metering becomes a common practice in Indian cities in the future, it is expected that several other prepaid metering service providers will be included under the scheme. Large-scale implementation could increase competition and make the meter costs more affordable.

3. Methodology

For evaluation of the pilot prepaid metering scheme, the experience of prepaid metering schemes implemented nationally and globally in other utilities was examined. The application and payment procedures of the current prepaid metering scheme implemented at BESCO on a pilot basis were studied. In order to evaluate the financial benefit of the scheme for BESCO, monthly consumption data of LT7 consumers were collected and analysed. A questionnaire-based survey was conducted for a sample set of consumers to assess the consumer perception about the scheme. This paper presents the findings of the analyses and evaluates the benefit of scaling up the scheme.

How does the scheme work?

While applying for a new connection, the applicant is required to submit the application form with details including name, site number, purpose of request for the connection, site details, and sanctioned load requirements. We observed that the connection requirements ranged between 1 kW and 18 kW, with a validity of 28 days in this pilot scheme.

Figure 1 illustrates the steps involved in the prepaid metering scheme. In this scheme, a consumer approaches the nearest subdivision office and submits the necessary documents and charges stipulated for each sanctioned load. Thereafter, the applicant is provided a prepaid energy meter and a smart card charged with the units corresponding to the payment made by the consumer. Once the consumer is registered with BESCO, he/she signs a contract for a limited period and begins using the service. At the time of making a transaction, a top-up machine at the Point of Sale (POS) records the status information, available credit, and power consumption data onto the smart card. Consumption of units begins once the consumer swipes the card over the meter at his/her premises. The meter switches off when credit is exhausted, which is when the consumer needs to recharge the smart card to avail the service again. The benefit to the consumer is that no additional charges are imposed upon reconnection. For the utility, issues related to overdue or non-payments do not arise.

A database server is the core of the revenue collection activity for a utility, which manages and stores all back-end applications and consumer-related information. While recharging at the POS, all the information is recorded and transferred to the meter vendor's database, which is routinely synced and updated with the utility's database. The consumer returns to the

subdivision only for making any payments/recharges and contract-related amendments. With consumer-related information and smart portals in place, utilities and consumers can effectively understand the usage pattern and methods to manage the demand effectively. (Kumar S. , 2010) In the future, when smart meters are installed, data from this database would be useful to form a baseline for the Consumer Information Portal.

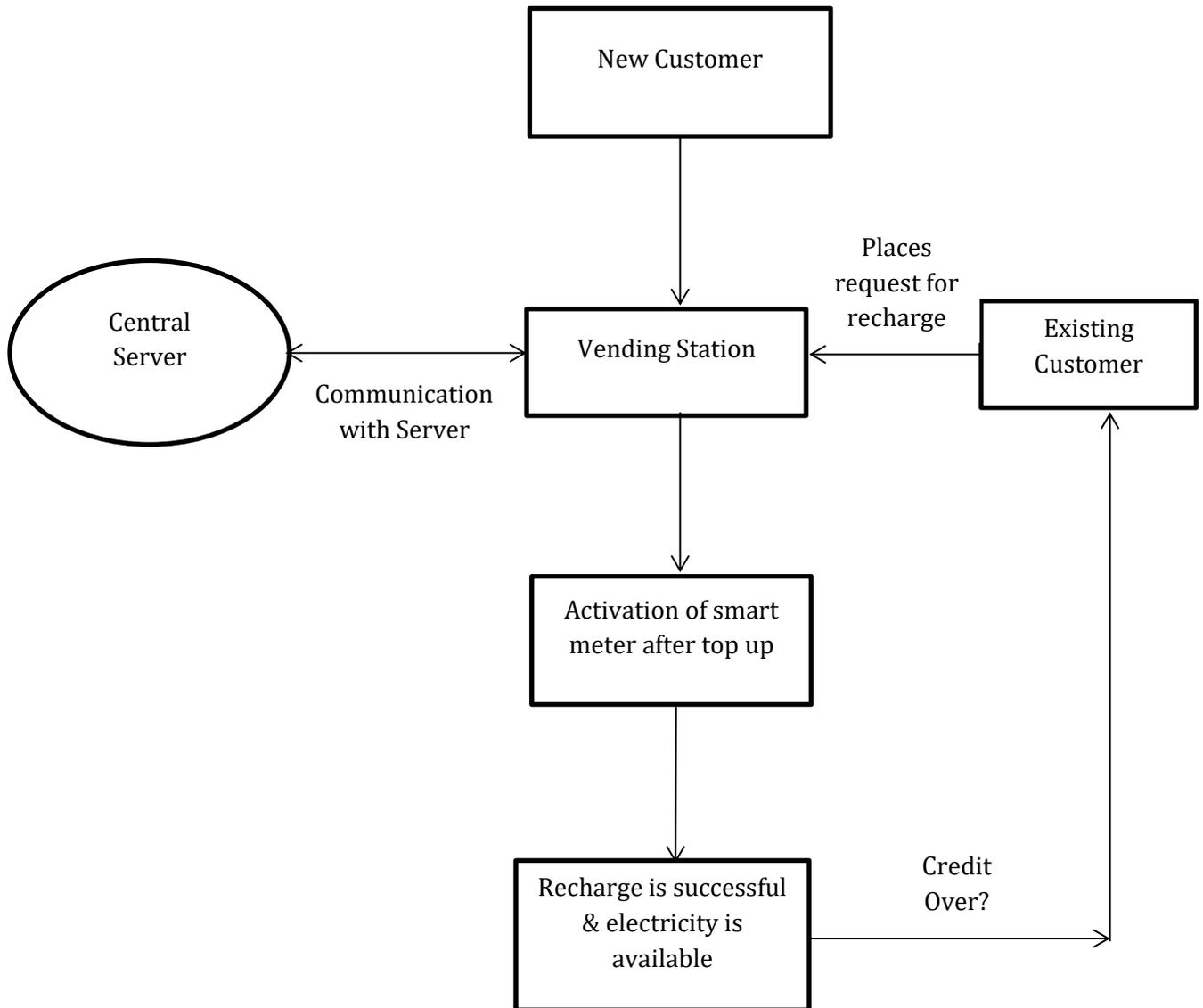


Figure 1: Steps Involved in the Prepaid Metering Scheme

Source: BESCO, CSTEP, 2015

Comparison between the old scheme and the new prepaid scheme

The steps involved from the activation of a new account to disconnection for both existing and pilot prepaid schemes are shown in Figures 2 and 3. Based on stakeholder discussions, we gathered that the utility officials were required to engage with consumers on more instances under the old scheme as compared with the prepaid scheme. The costs associated with visits to each meter site along with meter reading costs, preparation of invoices, and delivery of printed

receipts under the old scheme contributed to increasing the operational expenses. On the other hand, in the prepaid scheme, the utility's personnel were required to visit the site only at the time of installation and for removal of the prepaid meter at the end of the metering contract. Further, consumers had the advantage of making recharge payments based on their usage. Hence, the four-step prepaid metering scheme proved to be less time-consuming and labour-intensive for BESCO than the erstwhile six-step metering scheme.



Figure 2: Old schemes – six-step process



Figure 3: New prepaid schemes – four-step process

4. Revenue Realisation from the Pilot Project

“We are now confident of rolling out prepaid meters for temporary connections and cover the entire BESCO region progressively as our pilot project in Indiranagar division has been successful. These meters also ensure the consumer does not exceed the sanctioned load which otherwise would put enormous stress on transformers” (Balasubramanyam, 2015)

- Pankaj Kumar Pandey, ex-Managing Director BESCO

“The prepaid meter is user-friendly and saves us from physical visits to check for extra load. We have collected 2.32 crore rupees in less than eight months in Indiranagar division. This positive change was unprecedented” (Balasubramanyam, 2015)

- Narasimha Pandit, Executive Engineer, BESCO

“The use of prepaid meters will cut the meter reading costs to 3 crore rupees a year, from the present 18 crore” (Balasubramanyam, 2015)

- Rohit Bahadur, Managing Director, Supermax

While assessing the monetary gains, we analysed that the utility recovered significantly higher revenues from temporary connection consumers as compared with its previous records for the year 2014. The net change in revenue can be attributed to savings accrued primarily from (a) reduction in meter reading costs for the 3,525 prepaid meters and (b) penalty charges imposed due to breach of sanctioned load limits.

Under the old metering mechanism, based on stakeholder consultations, it was gathered that the utility spent approximately Rs. 11 for manual reading of each meter, which translated to a total of Rs. 38,775 for reading the 3,525 meters. It was analysed from the study that the costs associated with on-site meter reading were reduced to nearly zero. Under the prepaid scheme,

the utility had to spend only Rs. 2 per meter, which resulted in overall meter reading costs of about Rs. 7,050, resulting in revenue savings of roughly Rs. 31,725 for reading these meters. Further, there was an advantage of interacting directly with the consumers, which helped the utility officials in resolving their issues and increasing their satisfaction levels. 3,525 meters account for only 5–6% of the overall temporary customer connections that were operational at the time of the study in BESCO's jurisdiction. It is expected that the gross savings from meter reading for the utility could be much higher in the future if the utility chooses to replace all of its present meters with prepaid meters for consumers with temporary connections.

To analyse the revenue collected by the utility due to penalty charges, we compared the previous year's (2014) revenues with the revenue collected after installing prepaid meters for a select set of consumers who had similar sanctioned loads. For the purpose of conducting a comparative analysis, a representative sample of consumers was selected. Revenue for the selected consumers was collected for the same months of 2014 and 2015 to represent the seasonal behaviour.

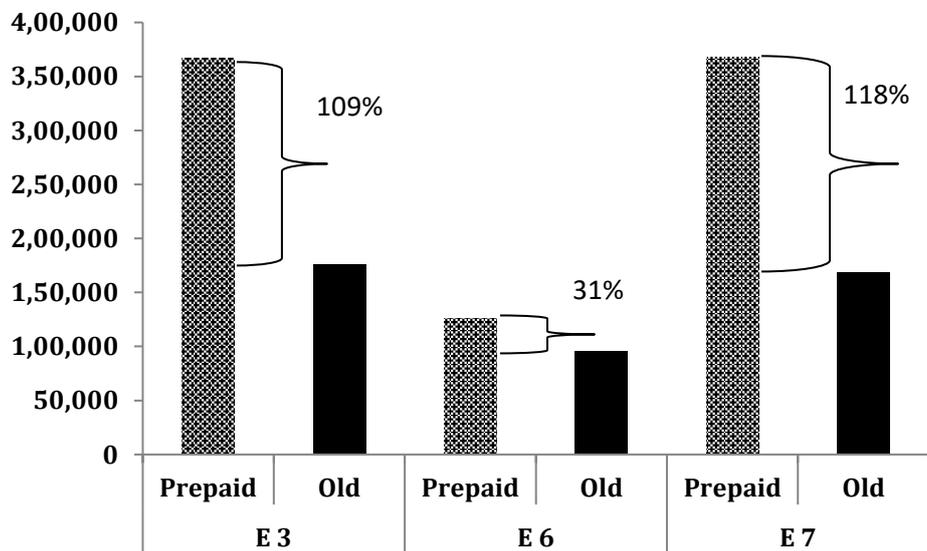


Figure 4: Increase in revenue for BESCOM due to the Prepaid Metering Scheme

Source: Vendor Database, CSTEP Analysis

Net revenue analysis (Figure 4) depicts that the prepaid metering scheme resulted in a significant increase in revenues across all subdivisions as compared with the old metering scheme. This is primarily attributed to a provision under the prepaid metering mechanism that allows the utility to record additional earnings received from imposed penalties, which were not getting recorded under the old scheme. Penalties are imposed when the consumers exceed their sanctioned load limits. However, it was observed in some cases that the units consumed with prepaid meters were higher as compared with that in the old scheme. This could be attributed to either change in intensity of activities or a case of rebound effect.

Under the old metering mechanism, the meters recorded only the overall amount owed by the consumer to the utility at the end of the month. The bill did not provide the exact breakup of how much penalty was imposed due to breach of sanctioned load, thereby not giving the consumer an accurate picture of any inefficient use of equipment on-site. Through the prepaid

metering scheme, consumers could track the amount of penalty they had been incurring, with a breakup of charges provided in the receipt at the time of making payments. The study analysed that BESCO earned a total penalty amount of around Rs. 14 lakh (as retrieved from the vendor's database).

Figure 5 shows the share of revenue earned by the utility across different subdivisions, which is attributed to the penalties imposed on consumers. Out of the five divisions, it was deduced that E4 had the highest share (60%) in penalty payments. Based on the stakeholder interaction with BESCO officials, it emerged that most of the temporary connections in the E4 subdivision pertained to construction sites, where consumers often breached their sanctioned loads. It is envisaged that the prepaid metering scheme would help the utility in reducing this inefficient practice, resulting in a significant improvement in the collection efficiency.

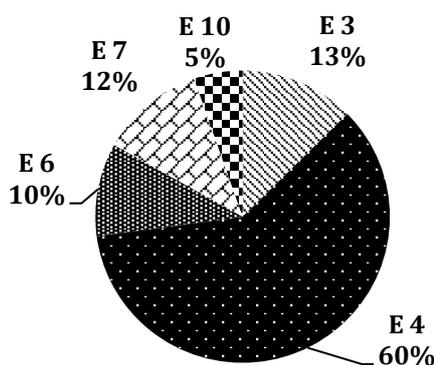


Figure 5: Share of Penalty Amount

Source: BESCO Data, CSTEP Analysis

5. Consumer Perception Survey Analysis

In order to gauge the overall perception and user experience of the prepaid metering scheme implemented on a pilot basis in the E3, E4, E6, E7, and E10 subdivisions, a questionnaire was circulated within a sample set of 100 consumers who were selected at random from across all subdivisions. However, these customers were selected from different sanctioned load bands (1 kW–17 kW) to ensure a near-accurate representation of all types of customers. Most of the temporary connections (around 74%) are taken for the purpose of construction-related activities, whereas the rest are taken for the purpose of running advertisement hoardings. Temporary connections taken for the purpose of hoardings generally run for only certain periods of the day, whereas construction activities may run throughout the day based on the availability of labour.

The survey questions were designed to cover consumers' response on quality of prepaid meter handling experience, ease of making payments, and awareness about the perceived benefits and special features. The study also captured the perspective of the consumers and utility officials on how the prepaid metering scheme has benefited them so far and how it could be made more effective in the future.

Perception of the Scheme

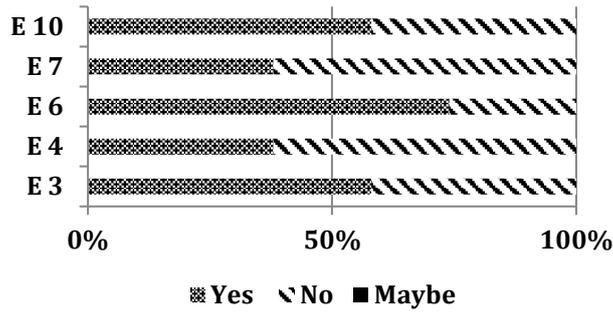


Figure 6: Prepaid scheme is better than the old scheme

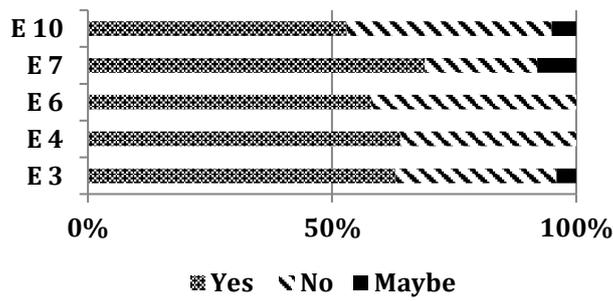


Figure 7: Prepaid helps optimise consumption

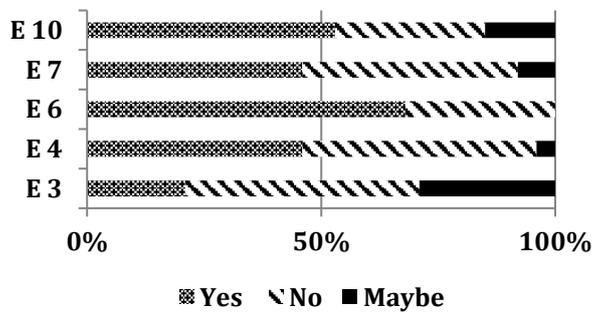


Figure 8: Prepaid is more affordable

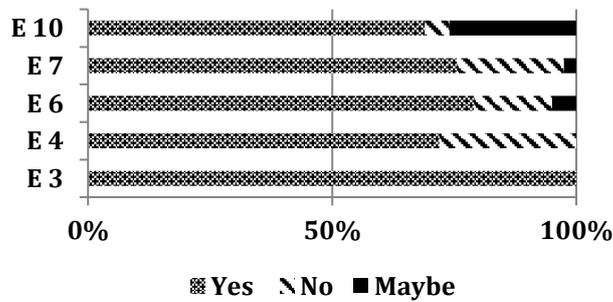


Figure 9: Work will get disrupted by disconnection

Overall, the majority of the consumers surveyed believed that the prepaid metering scheme is better than the old scheme (Figure 6). Proponents of this scheme across the five subdivisions felt that adopting a new regimen of recharging and operating the meter was fairly easy (as against their earlier perception). Connections taken especially for construction purposes require uninterrupted power supply, so it was initially felt that it would be a cumbersome task to adopt prepaid meters. However, the perception changed after having the ability to monitor consumption using prepaid meters.

Figure 7 depicts that around 50–60% of the consumers surveyed across all the subdivisions perceived that prepaid meters helped in optimising their consumption. This was because the consumers could make flexible recharge payments and could buy the exact number of units they would require at their sites. Tewari and Shah (2013) stated that prepaid metering allows consumers to have a better understanding of how much energy is being consumed and enables them to monitor their expenditures (Tewari & Shah, 2003).

Around 40–50% of the consumers believed that the scheme is more affordable as prepaid metering allowed them to control and monitor their consumption based on their financial situation (Figure 8). Most temporary connection owners have intermittent revenue streams as their work is contractual; hence, they felt that prepaid meters gave them flexibility in making payments so they could keep their connection alive. However, some consumers did express that expenditure on electricity bills did not show any reduction because of prepaid metering. This could be attributed to the fact that their consumption patterns had remained the same, hence no reduction was seen in the bills.

More than 70% of the consumers surveyed expressed that the prepaid metering scheme disrupted their work/operation in cases when the meters ran out of units (Figure 9). Some of them even expressed that they felt safer with the earlier scheme because there was no fear of disconnection in the middle of the month. From the consumer's perspective, this concern is understandable as poor forecasting of their consumption patterns could result in the disconnection of the meters and may impact their project timelines. Top-up options such as crediting the meter via text message, smartphone application, or a phone call, as well as through an online or in-home display placed at convenient locations, provide greater consumer choices and convenience, thereby encouraging them to adopt this scheme without apprehensions related to disconnection (Accenture, 2013).

Meter Handling Feedback

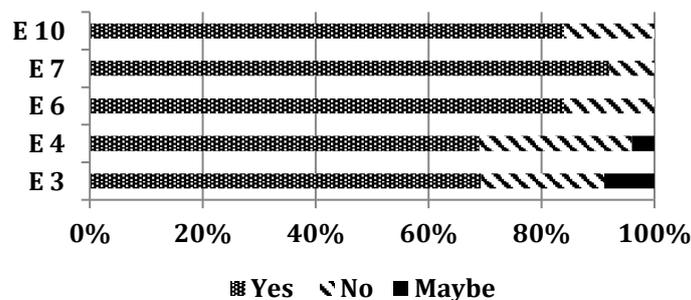


Figure 10: Display on meter is informative and useful

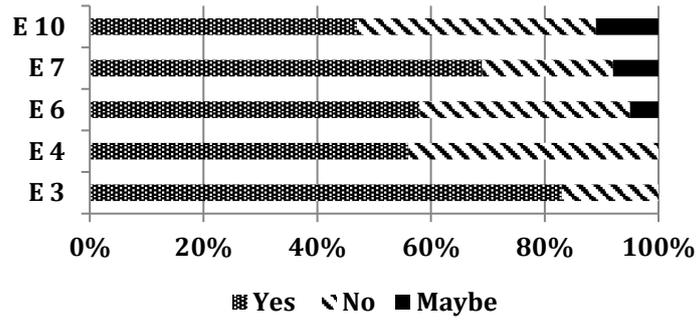


Figure 11: Recharge POS is far

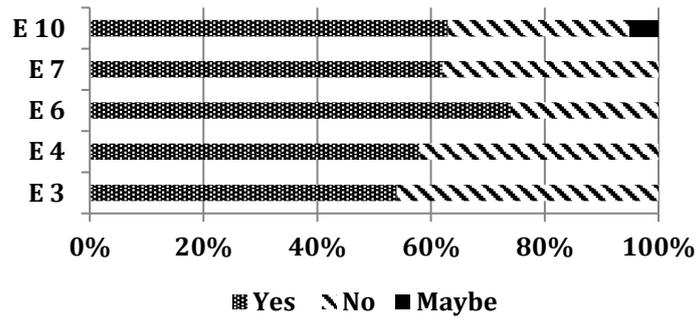


Figure 12: Mode of payment is convenient

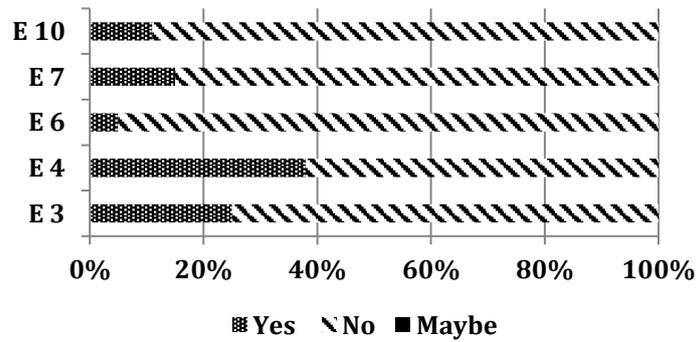


Figure 13: Meter develops faults regularly

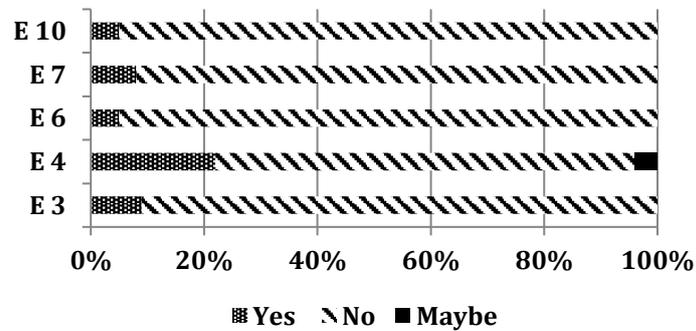


Figure 14: Regular issues while loading credit on card

More than 70% of the customers surveyed across all subdivisions expressed that the display on the meters is informative and useful (Figure 10). The Light-Emitting Diode (LED) display on the meter made them aware of the units available in their account, which allowed them to plan their renewal/recharge payments with ease. Further, it helped them to get prior information about upcoming payment due dates.

Consumers are required to visit a POS every 28 days to renew their contracts, unlike the old metering system. As can be seen in Figure 11, more than 50% of the consumers surveyed across the subdivisions expressed that the POS centres were located very far from their sites and that they found travelling to these centres for the purpose of making payments very cumbersome. This requirement of visiting the POS centres multiple times every month (to make any kind of renewal or recharge payments) impacted the consumers' satisfaction levels.

Figure 12 depicts that 50–60% of the consumers surveyed in four (E3, E4, E7, and E10) of the five subdivisions felt that the mode of payments in the prepaid metering scheme was convenient. Some preferred the option of paying through all formats, including cash, debit card, and credit card. Most of the owners who applied for a connection were in favour of card-based transactions as it maintained transparency between them and the hired contractors. But in cases where the meter connection was taken by the contractors directly and the owner/financier had minimal involvement, the contractors preferred cash transactions.

Figure 13 shows that 85–95% of the consumers surveyed in the E6, E7, and E10 subdivisions felt that the quality of prepaid meters supplied was good and they rarely developed faults. Nearly 25–35% of the consumers experienced problems at the time of installation of meters; however, they mentioned that the utility solved their problems in a timely fashion. Across all the subdivisions, consumers expressed that they were happy with the recharge process and did not face any issues while recharging their cards using the smart card technology (Figure 14).

Awareness about special features

Figures 15 and 16 illustrate the awareness levels of consumers about special features—the SMS/call reminding service and the happy hour feature.

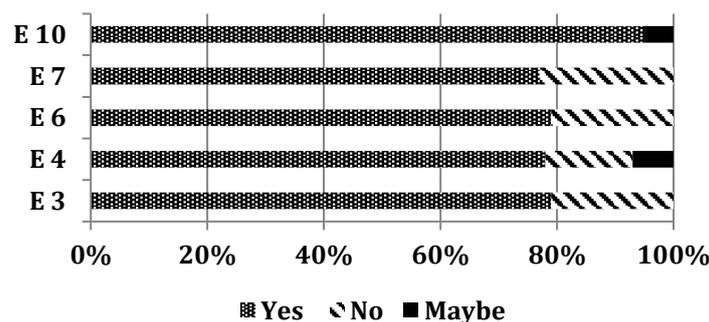


Figure 15: Awareness levels about SMS/call service

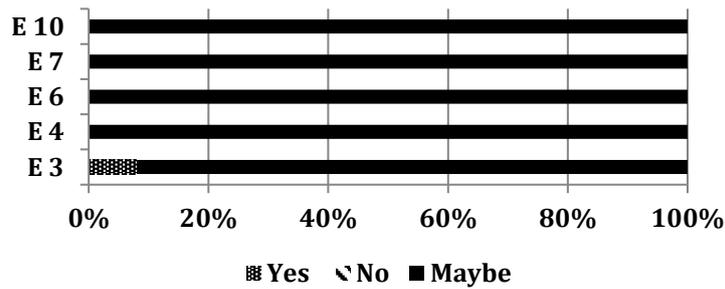


Figure 16: Awareness levels about happy hour feature

More than 75% of the consumers surveyed across all five subdivisions felt that the notification feature helped them make payments before due dates and avoid disconnections (Figure 14). The repeated payment-related reminder alerts sent by the vendor helped the consumers plan their visits to the recharge points in advance. On the other hand, consumers were not aware of the benefit of the happy hour service, which grants a grace period before the deadline of making payments.

Consumer Recommendations

Figure 17 captures consumers' suggestions for improvements/upgrades to the ongoing prepaid metering scheme.

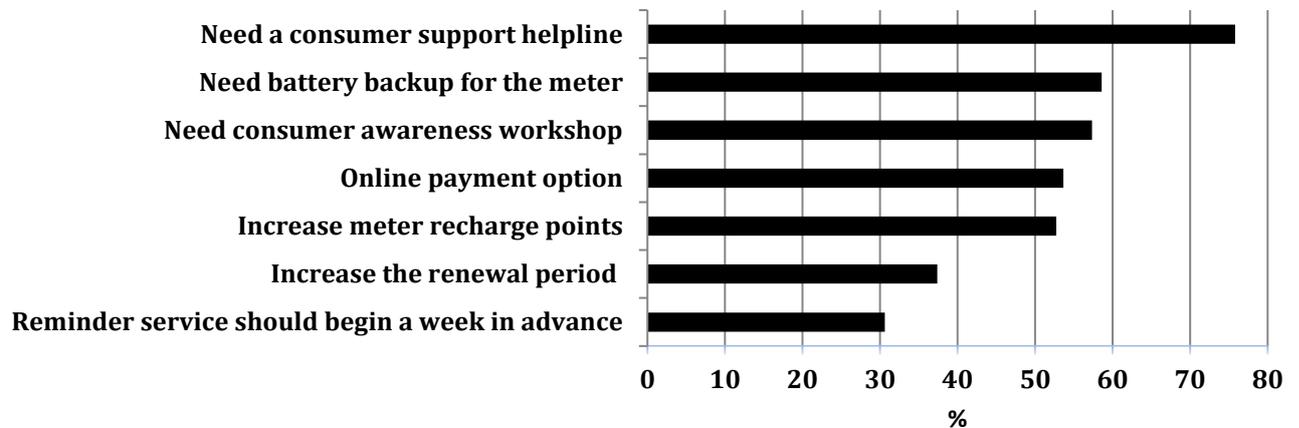


Figure 17: Recommendations from the consumer survey

More than 70% of the respondents across all subdivisions agreed with the idea of establishing a consumer support helpline to register the problems faced by customers. To date, subdivisions have had to accommodate long queues of consumers waiting to register their complaints. Having a 24*7 helpline to address the grievances could help eliminate this problem.

Further, the meter switches off during power cuts, disrupting work and not allowing the consumers from seeing information (such as upcoming payment warnings, remaining power units, etc.) on the LED display. Nearly 60% the consumers felt that prepaid meters should be supplied with battery backup in order to avoid deactivation during power cuts.

Fifty-five percent of the consumers supported the need for having consumer awareness workshops. It was inferred from the survey that participation should be made mandatory for all new connection holders to make them aware of all the procedures involved in order to avoid paying heavy penalties. Frequent awareness workshops and outreach campaigns would help the consumers understand the benefit of the scheme.

Consumers in general felt that more POS stations should be established around the subdivisions' jurisdiction to reduce the inconvenience of travelling long distances to these POS centres. More than 50% of the consumers surveyed felt that more payment kiosks could be set up across the city to make recharging more convenient. Consumers unanimously suggested that having an online payment mechanism could further help save travelling time and transportation expenses.

More than 30% of the consumers felt that the renewal period should be increased from the current 28 days to at least 56 days. According to them, the majority of the temporary connections are taken for a duration of at least 3–4 months, and hence making additional monthly trips solely for the purpose of making renewal payments does not seem desirable. According to utility officials, this practice of maintaining a 28-day cycle was integrated for monthly audit purposes, but extending it to 56 or 128 days could be considered.

Around 30% of the consumers felt that the SMS/call reminder service should begin a week in advance instead of the current 3-day period. Extending this period could help consumers in planning their activities, consumption pattern, and recharge cycle more efficiently.

6. Conclusion

Prepaid electricity provides both the utility and consumer benefits that accrue in various forms and contribute to efficient functioning of the electricity production, distribution, and revenue generation (Tewari & Shah, 2003). For utilities, prepaid meters have proved to be financially and socially beneficial. The prepaid metering scheme has helped in bringing transparency in tracking the consumption and associated expenditures pertaining to electricity bills, an increase in collection efficiency, and a reduction in operational and maintenance costs. Another significant advantage for the utility is the facility to track violations of the sanctioned load. Further, the information would help the utility in predicting the demand pattern more effectively, and could be used for future demand forecasting. This would in turn help the utilities use the recharge pattern database to manage the demand and power purchases effectively. The findings from our evaluation study show that prepaid metering not only brings about favourable change in social welfare for consumers, but also helps the utility in reducing its arrears and reducing operational costs. Prepaid metering as a mechanism could be incorporated by other utilities, which would supplement the Ujwal DISCOM Assurance Yojana launched by the Government of India (Casarin & Nicollier, 2009).

For consumers, the benefits arise from better management of their load and electricity bills. Based on the survey findings, more than 50% of the consumers in all the subdivisions felt that the prepaid metering scheme is better than the old scheme, which indicates that the scheme has gained popularity at least within the temporary connection category of consumers. Features like LED display on the meter and the SMS/call reminder service, which enable them to make timely payments without disrupting their work, were well appreciated. For consumers, prepaid meters

capture the penalty component in the overall bill, which is helpful in reminding consumers to monitor their usage more efficiently. Going forward, wider outreach and awareness campaigns to propagate the benefits of prepaid meters would help consumers willingly adopt this scheme.

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