Modernization of Metering, Billing and Collection System, the Customer Relationship Management

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Abstract— Reform programmes in India in the Electricity sector are going on in the top priority. This paper presents latest trends in metering technology and state of art practices for meter reading, billing and collection of revenue. With the special emphasis on customer relation management.

I. INTRODUCTION

Reform programmes in India in the Electricity sector are going on in the top priority. The Electricity Regulatory commission Act 1998 (the ERC Act of 1998) enjoins the Central Electricity Regulatory Commission (CERC) to promote competition, efficiency and economy in the electricity industry. For the successful implementation of the reform programme in Electricity sector accurate and exact measurement of power is one of the important function. Energy meters installed at the consumer terminals provides the basis for the billing of the energy consumed. Besides this, the meter reading also help in the computation of energy loss in the distribution network.

This paper presents latest trends in metering technology and state of art practices for meter reading, billing and collection of revenue. Meter reading billing and collection known as MBC activity deals with millions of utility consumers and therefore MBC function has to be oriented to provide best customer service. Quality service not only improves the image and good will of utility in the society, but also helps in many ways in improvement of revenues of the utility. Obviously all customer related functions have to be integrated and provided as single point service, for minimization of cost and value addition. Such an integrated service is called “customer relationship management” popularly known as CRM. The following issues are identified and addressed in this paper with specific reference to customer service.

1) What are the latest trends in metering technology and their relevant to Indian context.
2) How to automate meter reading, billing and collection systems?
3) How to integrate these customer related function in the total concept of CRM?

II. LATEST TRENDS IN METERING TECHNOLOGY

The latest trends in Metering Technology

1) Electronics meters
2) Pre paid meters
3) Split meter
4) Remote meter
   Walk by system
   Mobile system
   Cable Network
5) Power line carrier metering

1) Electronic Meters

The power utilities across the world are changing over to electronic meters from traditional electro mechanical meters for the following reasons:

1. The meters are accurate and the variation in error with the load is negligible.
2. The meter can record several parameters as defined by user i.e. maximum demand, KWH, KVARH, Power factor.
3. Meter has the facility of storing data for 30 to 35 days, to enable the utility to perform load survey and monitor the contracted demand, power factor and tampering of meters.
4. Meters does not have any moving parts, therefore the revenue lost due to stuck meters can be totally eliminated.
5. Meters have a tamper detection facility to detect loss of potential, reversal of current and by passing of current circuit.

2) Pre paid Meter

The pre paid meter is fitted with MCCB. The software inbuilt in the meter opens the MCCB after predetermined energy is delivered. They are of two types, called key pad meters, smart card meters. In the keypad system, a number is generated by the credit vending machine which the consumer punches on the key pad provided on the meter and meter continues to provide electricity upto the amount paid by the consumer. In this system, there is no feed back available on the pattern of the consumption of the consumer as well as the reading of energy consumed.

Smart Card provides a communication with the credit vending machine and the utility’s computer. At the time of re-charging the card, the data stored in the meter memory is conveyed back to the data base of the utility for analysis of the consumption pattern etc.

The main advantage of the system is that the function of metering, billing and collection is combined into one activity.
and easy to implement for the utility. The disadvantage of the system is that the consumer by passes the meter and utilizes the energy, the utility might not be able to detect easily. The customer installation has to be made theft proof, by taking the service wires through a flexible conduit from the pole and ending in a meter box. The alternative solution is to go in for a split prepaid meter. The present cost of these meters are approximately Rs.10,000/-. This cost is prohibitive, as this amount is to be recovered by consumers. Moreover the reliability of these meters is still to be proved in our environmental conditions and usage practices.

3) Split Meter System

This system is similar to Walk-By-System except the meter is Split into two parts, namely metering unit and display unit. About 8 or 12 8 metering units fitted with a low powered Radio Module are housed in a dust-proof, moisture proof pole mounted housing conforming to IP54 and installed on pole. Further, each meter can be equipped with MCB of appropriate rating to disconnect the service in the event of any abnormal condition. The user interface unit fixed with energy recording device (counter) is installed in each consumer premises, which are connected to the pole. A MRI or Lap Top computer is provided to meter reader to capture the meter readings. The advantage of this system is that it effectively controls the theft of energy and at the same time makes the meter reading simple and effective. Though the system is expensive, the cost will pay for itself through increase in revenue due to prevention of pilferage of energy.

4) Remote Metering – Walk – By System

In this system, the individual meters are equipped with a radio module operating on 184 MHz or 430 MHz or 900 MHz frequency. The meter reader is equipped with a MRI or Lap Top computer coupled to a radio module. In this scheme as the meter reader walks in the street along with the MRI, Meter readings from the meters are collected by MRI Typical Range of MRI is 50 meters distance and number of meters that could be read is around 200 meters in 3 seconds. The MRI is equipped with interrogate/ receive software and also “Routing” software that enables the meter reader with details of the consumers located in that route. The advantage of the system is that it makes meter reading simple and effective. The disadvantage of the system is that it is difficult for the utility to detect attempts to bypass the meter and pilfer energy. This system may not be appropriate due to widely prevalent theft and pilferage of energy in the utilities.

Remote Metering – Mobile System : The scheme is similar to walk by system except that meter readings are collected using a Rugged Industrial grade PC Computer with suitable Trans receiver installed on a vehicle. In this scheme as the meter reading vehicle fitted with mobile reading unit moves in the street, it interrogates/receives, the meter readings from the meters which are within vicinity of 50 meters. Typical speed of meters read is around 200 meters in 3 seconds. The advantage of this system is that it makes meter reading very simple and cost effective. The disadvantage of the system is that it is difficult for the utility to detect attempts to bypass the meter and pilfer energy. This system may not be appropriate due to widely prevalent theft and pilferage of energy in the utilities.

Remote Metering – Cable Network : This system is ideally suited for Multi storied Blocks. In this System, Energy Meters are equipped with a optically isolated RS-485 port. These meters are connected on a multi-drop network in various flats of a block. A Data Collector or a Data Logger Unit interrogates at regular programmed intervals the meters and gathers the data and stores it. The Data Logger Unit further can be equipped with a telephone modem and can be interrogated by a Central System through PSTN network. Alternatively, the Data Logger is also provided with a optically isolated IEC 1107 compatible port through which the meter Reader by means of a MRI can down load the data. The system can be extended to meters located in wide area, if the buildings are covered by optical fiber cable network. This system is cost effective in case of multi storied buildings and when houses are connected with an optical fiber cable network.

5) Remote Metering – Power Line Carrier

The system is similar to Remote Metering Using cable network except that communication medium is Power line providing power supply to customer. Power line carrier uses Ultra Narrow Bandwidth (UNB) technology. Each meter is fitted with a Turtle transmitter to transmit on its own private frequency programmed into the Turtle transmitter when it is installed. The standard Turtle transmitter transmits one complete bit of information every 40 minutes, so a complete data packet is sent every day. It continually transmits as long as the meter has power. The main advantage of the system is that the meters which are difficult to access can be read and effectively monitored. This system may be suitable for metering agricultural consumer which are difficult to access. The meter readings may be collected at a convenient point i.e., either a substation or a point in the network nearer to the road. This system also has the disadvantage that by-pass of the meter cannot be detected easily by the utility.

III. AUTOMATION OF METER READING AND BILLING

Regular and correct meter readings coupled with prompt billing and serving of bills is the most important activity to safeguard the revenues of the utility. The option of remote metering address the problem of meter reading but the issue of serving the bill is un-addressed. Computerised Spot Billing (CSB) address the problem of meter reading to a great extent and fully address the problem of bills serving.

RAM of 3 to 8 MB
♦ Work on DOS/Windows operating system
♦ Good display facility
♦ Alphanumeric Key Board to enter meter readings and observations of meter reader
♦ Battery backup
♦ RS232 port for import and export of text and data from/to computer system
♦ Capability to import meter readings and export meter settings from/to meters
The process of CSB is explained hereunder on-line bill collection is described herein. System serves these requirements effectively. The process of computerized on-line bill collection is provided by the utility. Computerized On-line Bill Collection system are described in the paper.

IV. AUTOMATION OF BILL COLLECTION SYSTEM

Financial health of any utility solely depends upon collection of bill amounts from the consumers. To ensure prompt payments by consumers proper facilities have to be provided by the utility. Computerized On-line Bill Collection System serves these requirements effectively. The process of on-line bill collection is described herein.

The consumer goes to the cash collection center and produces either the bill or informs the consumer number. Bill collector enters the consumer number into the system and gets a display of the bill and the amount to be collected. Bill collector collects the amount from the consumer, generates a computerized receipt for the amount paid and issues the receipt.

Simultaneously the database and the consumer ledgers are updated. This ensures that the amount paid is properly accounted for. Any errors in entering the consumer number or the amount can be easily detected by the consumer and rectified on spot.

A defaulters list can be obtained every day for the area, which line staff proposes to visit for effecting disconnections on that day. This ensures updated defaulters list and avoids inconvenience to the consumers due to old defaulters list.

The issue of a receipt for the amount paid is very fast and it reduces dramatically the time of waiting by the consumers due to old defaulters list.

The issue of a receipt for the amount paid is very fast and it reduces dramatically the time of waiting by the consumers to make a payment.

Future Upgradations: The system will be enabled for e-commerce applications at a later date, providing the following facilities.

- The consumers can login through Internet and print or view the bill. The consumer can also review the payments made by him so far.
- A facility will be provided to pay the bill amount through credit cards or debit cards or bank transfer by issuing an authorization to the bank for debiting the bill amount to his or her account.
- Facility will be provided for giving a general authorization to utility to debit the bill amount to his or her bank account provided the bill amount does not exceed specified amount.
- Payment counters for receipt of bill amounts will be provided at user convenient locations like, banks, post offices, petrol bunks, super bazaars etc., and connected on line to the central computer system at the circle office. This will enable the consumers to pay the bill at the place most convenient for them and at the time convenient for them and at the time convenient for them. The agency collecting the amounts will be asked to deposit the amount into designated bank accounts. In respect of private parties, suitable security to cover two or three days’ collection will be obtained. If there is any delay in depositing the amount the online collection will be disabled at the central computer system and suitable action will be initiated to recover the amount collected. The main advantage of the system is that the cash collection center is connected on line to the main computer system at the circle office and all the transactions are recorded in the central database. The agency collecting need not maintain any books of account for the transactions. The collecting agency will have the advantage of publicity and improving his consumer base and business.

V. COMPARATIVE ADVANTAGES OF PROPOSED SYSTEM

The table below indicates the drawbacks of the present system and how they are addressed in the proposed system.

<table>
<thead>
<tr>
<th>Drawbacks of Present System</th>
<th>Solutions in proposed System</th>
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<tbody>
<tr>
<td>Issue of manual receipt at cash collection centers takes a long time and consumers wait for hours in queue for payment</td>
<td>Computerised receipt generation shortens the time for issue of receipt</td>
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<tr>
<td>Payments are received at the cash collection centers only on working days and that too during office hours i.e., to 10.30 to 2.00</td>
<td>Contemplates internet based payments through creditcards, debiting of bank accounts etc</td>
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<tr>
<td>The consumers are assigned to specified bill collection center. In other words they have to go to specified place to pay their bill</td>
<td>Provides for payment at any location</td>
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The future upgradations will include computerized on-line bill collection and the consumer can pay the bill using the proposed system.
consumer has to pay his amount at that collection center only. Generally the people will be working at a different place from the place of their residence. If they have to make a payment they have to take time-off from their work and come to the bill collection centers at their residence for payment. This is one of the irritants to the consumers who desire to make payment promptly.

There were instances of the defalcation of the amounts collected by bill collectors have occurred

There are number of instances of wrong booking of payments received from consumers resulting in wrong bills, wrong disconnection of supply etc. causing avoidable inconvenience to the consumer.

The preparation of defaulters list is not update as there is a time lag between the receipt of payment and its accounting. With the result the line staff finds a number of consumers listed in defaulters list have already paid the amounts.

The non-collection of amounts promptly not only leads to accumulation of amounts but also creates difficulties in recovery of the amounts at a later date.

VI. INTEGRATION OF MBC FUNCTION WITH CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM

Customer is the most important facet of utility operations. With increased competition and globalisation, the Customer Relationship Management (CRM) has assumed a great importance in Utility Management. The ten important services of CRM in a power utility are:

1. Regular Meter reading
2. Timely delivery of Electricity Bill
3. Easy Facilities for Payment of Bill
4. Proper accounting of amounts paid by him
5. Prompt attendance of Fuse-Off-Call or any complaint relating to loss of power supply
6. Prompt attendance of complaint on quality of power supply like low voltages
7. Easy and quick facilities for registration of Application for New service
8. Planning proper supply arrangements to meet customer demand and quick release of service
9. Correct and easy information on Tariffs and Terms and conditions of Power Supply
10. Single point Customer Service

These ten services are grouped under four sub-systems described below:

**Metering and Billing Management**: This system deals with reading of meters, preparation of bills and serving of bills to customers. The functions of this system are:
- Regular Meter reading
- Timely delivery of Electricity Bill

**On-line Collection Management**: This system deals with collection of bill amounts and accounting the amounts received from the customers. The functions of this system are:
- Easy Facilities for Payment of Bill
- Proper accounting of amounts paid by him

**Trouble Call Management**: This system relates to attending of trouble calls quickly, effectively and courteously. Trouble Calls are the complaints of the customer on Power Supply availability, quality and reliability. The functions of this system are:
- Prompt attendance of Fuse-Off-Call or any complaint relating to loss of power supply
- Prompt attendance of complaint on quality of power supply like low voltages.

**New Customer Management System**: This system relates to release of new services to prospective customers. On-line new customer Management System will automate the existing procedure by a large extent and also ensures that network and customer data is consistent, accurate and update. The functions of this system are:
- Easy and quick facilities for registration of Application for New service
- Planning proper supply arrangements to meet customer demand and quick release of service
- Correct and easy information on Tariffs and Terms and conditions of Power Supply.

**CRM Centre**: The CRM Centre or CRM Unit is the single point centre where customer can get all the service required from the utility.

VII. SYSTEM ARCHITECTURE

An Integrated Computerised On-line system combining all the four sub systems namely Meter Reading and Billing system, Collection System, Trouble Call Management, and New Customer Management System is proposed. This System shall be based on Web Application Architecture.
exploiting intranet and Internet technologies. The proposed system architecture comprises of a CRM Centre at a central location of the utility like the District Headquarters or Circle Office or Corporate Headquarters, etc., and numerous CRM Units at locations like the divisional offices, sub divisional offices, substations, etc. The number of CRM Units is determined, considering factors like customer density, geographical extent, revenue realized, etc. A typical CRM system is shown in Fig.1.

**Facilities configuration for CRM Centres**
- A set of servers handling different functions is connected in a cluster to provide hot line stand by and uninterrupted computing.
- The center will be manned round the clock.
- RAID Architecture will be incorporated to provide data security.
- An integrated centralized database encompassing all the functions will be maintained on the server.

**Facilities configuration for CRM Units**
- A set of PCs networked in a LAN is connected to the servers at the CRM Center function as thin clients.
- The number of PCs is determined by the workload handled by the Unit.
- PCs at CRM units are loaded with a Browser like Netscape Navigator, Internet Explorer, etc. only.

**Network Configuration**
- The CRM Center and CRM Units are interconnected using either Leased Telephone Lines or Dial Up Lines or Internet.

**Advantages of the CRM system Architecture**
- Any customer can access the CRM Center through the Internet.
- Customer can get all the services of CRM by approaching a CRM Unit through telephone or personally.
- Minimum number of Computer specialists are required for running a CRM System as System administration, Data base Administration and Applications Maintenance is centralized at CRM center and only web browsing facility is provided at CRM Units.

**VIII. IMPLEMENTATION STRATEGY**

Two alternative strategies are proposed for implementation of CRM System. One is the traditional approach where the utility makes the investment for hardware and software and imparts specialized training to its personnel to man the system. This approach has the following difficulties.
- The process of calling for bids and performing techno-economic evaluation of the bids is time consuming.
- Retention of skilled manpower capable of maintaining such systems is the most difficult task.
- The initial investment to be made by the utility is substantially high.

- The utility has to continuously upgrade the software and computer system to keep abreast with the latest technology.

The latest trend in application management is utilizing services of ASPs (Application Service Providers.) In this approach, the ASP will invest in hardware and software and establish the system. He will be responsible also for maintenance of the system. No initial investment need be made by the utility and payments to ASP start only after the system is fully commissioned to the satisfaction of the utility. The utility will enter into a contract for a specified period, say three or five years and pay the ASP on a per transaction basis or customer basis. The utility will be able to access these services through intranet/internet by procuring ordinary PCs and connecting them to the ASP server. This approach addresses all the problems of the utility experienced in the traditional approach.

**IX. CONCLUSION**

The modern MBC System and how it can be integrated with full fledged CRM is described. The different strategies for implementation are discussed and how the latest trend of implementation through ASPs will meet the requirements of the utilities. The implementation of the proposed system will go a long way in improving the customer service in the utilities.

**REFERENCES**