3.2 Implementation of information technology in the low tension billing system

Highlights

The low tension billing system, a mission critical in nature installed by the Board lacked some of the important controls like administrative, input and processing controls.

(Paragraph 3.2.1)

There was no system for changes to the program on account of tariff revision and formal acceptance of changes *etc*.

(Paragraph 3.2.7)

Effective control over meter reading, the vital input for computation of energy bills, was lacking as the system did not monitor compliance to the Board's rules for test check of meter reading.

(Paragraph 3.2.9)

There were flaws in programming logic for calculation of bills.

(Paragraph 3.2.12)

The billing system was not effective in achieving the objectives of timely issue of bills, collection of shortfall in security deposits and recovery of dues from consumers.

(Paragraphs 3.2.15 to 3.2.18)

Introduction

3.2.1 The Board was incorporated in 1960 under Section 5(1) of the Electricity (Supply) Act, 1948[$] with the main objective of generating, transmitting and distributing electricity in the state of Maharashtra. The Board's consumers are broadly divided into two categories *viz.* high tension (HT) consumers and low tension (LT) consumers. There are 1.53 crore LT consumers (March 2004). LT consumers contributed Rs.5,738.98 crore (43 *per cent*) to the Board's revenue during 2003-04. The computerised LT

[$] Since replaced by the Electricity Act, 2003.

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Low tension billing system is mission critical in nature.

Billing system was implemented in 1985 in COBOL* on UNIX** platform through A.F. Fergusson and Company. The total investment in information technology system was Rs.12.94 crore as on 31 March 2004. Considering the large number of consumers, significant contribution to the Board's revenue, wide dispersal of Information Technology (IT) centres and dependency of the Board on the system for raising bills and monitoring collection of revenue, the LT billing system is mission critical in nature.

Objectives of low tension billing system

3.2.2 The main objectives of the LT billing system as set out by the Board were as under:

- to reduce the time lag between meter reading and issue of bills;
- to provide accurate and up to date billing and accounting information;
- to provide means to effectively control billing operations and to initiate prompt follow up action in case of non payment of energy bills; and
- to review security deposit on a regular basis and to collect shortfall in deposit whenever required.

Organisational set up

3.2.3 The overall management of the Board rests with the Board of Members constituted by the State Government. The IT department functioning under the Accounts Member is responsible for the IT functions of the Board. A Director heads the department and is assisted by one Additional Director and three Joint Directors at Head Office and by Joint Director/System Analyst at 25© IT centres. The IT department is responsible for monitoring the implementation and maintenance of LT billing system while the IT centres are responsible for processing the data and generation of bills/reports.

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* COBOL – Common business oriented language.

** UNIX – Operating system developed by UNIX.

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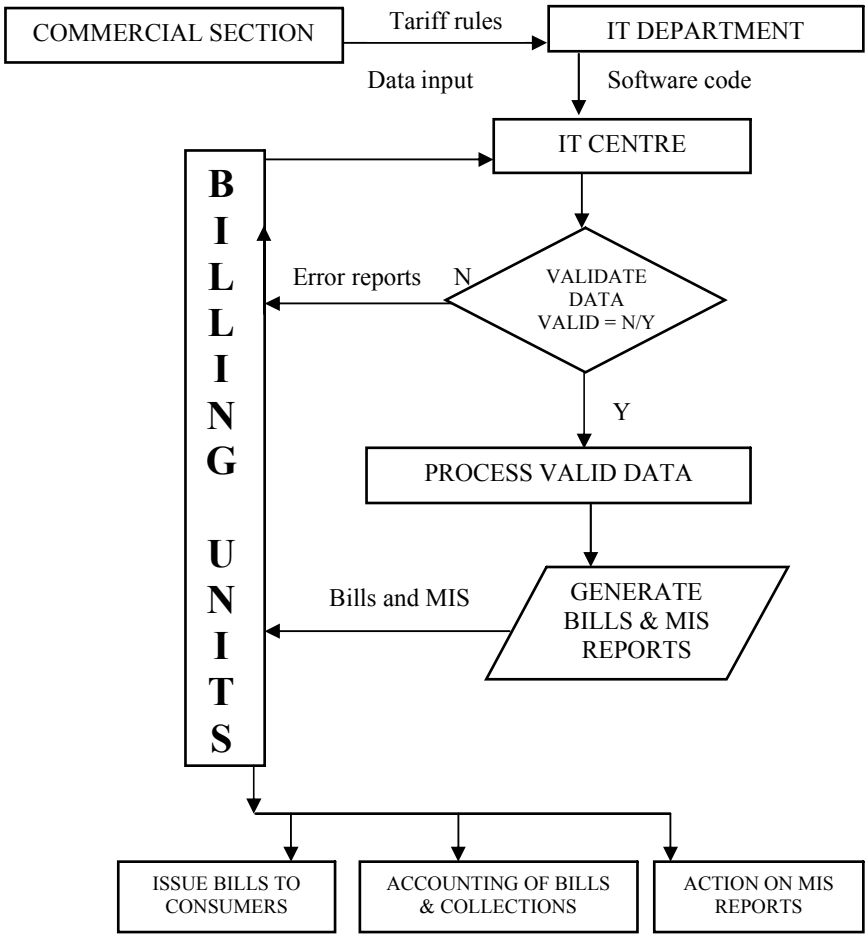
A chart showing functional set up is given below:



The Commercial Section headed by a Technical Director (Commercial) is responsible for communicating to the IT department the changes required in the LT billing system consequent upon changes in tariff rules. The IT department is responsible for carrying out modifications to the system and communicating the same to the IT centres. The billing units (sub divisions) are responsible for submitting data relating to billing activities such as release of new connection, meter reading, replacement of faulty meters, collection of revenue *etc.* to the IT centre. The IT centres are responsible for processing the data, generation of bills and to furnish accounting and Management Information System (MIS) reports to the billing units and management.

Scope and methodology of audit

3.2.4 During November 2004-February 2005, Audit reviewed the IT system using Control Objectives for Information and Related Technology (COBIT) rules and evaluated the effectiveness of the system in achieving the

organisational objectives of reduction in time lag for issue of bills, provision of accurate billing and accounting information, proper follow up action for recovery of dues and collection of shortfall in security deposit. This was done through evaluation of management controls and analysis of data, using 'IDEA'[$], in respect of 62 *per cent* of LT consumers for the period June 2001 -March 2005[#] in 13[*] out of 25 IT centres.

Salient features of LT billing system

3.2.5 The LT billing system covers all functions starting with sanction of new connection to a consumer, periodical meter reading, preparation and issue of bills to consumers, collection of amounts billed, collection of shortfall in security deposit and meter cost *etc*. The salient features of LT billing system are as under:

- Basic inputs comprise master, static and transaction data. Master data relate to data pertaining to each consumer *viz*. consumer number, billing unit, processing cycle, details of address, applicable tariff code, duty code *etc*. Static data refers to data in respect of the connection such as date of connection, connected load *etc*. as well as details regarding the meter installed for measuring consumption. Transaction data relate to the periodical data pertaining to the meter reading, status of meter, payments by consumers *etc*. Master, static and transaction data are linked to each other by consumer number.

- Data input is done in batch mode. Separate batch cards are prescribed for different types of data and for their modification. Batch cards are prepared by the sub divisions giving batch totals for prescribed key fields and data entry is got done through outside agencies.

- Data furnished by the billing unit is validated at IT centres and errors, if any, are got corrected through the sub divisions. Validated data are then to be processed at IT centres in the LT billing system through sequential program operations.

- The output of the LT billing system comprises bills to be issued to the consumers, data regarding billing and collection to be passed on to accounts section for accounting and MIS reports for effective control over billing operations such as replacement of faulty meters, verifications of consumption, disconnection of supply in case of non payment of dues and follow up of recovery *etc*.

[$] Interactive Data Extraction and Analysis – a software developed by CASEWARE IDEA INC as a computer assisted auditing tool.

[#] Data was not uniformly available in all cases up to March 2005, therefore latest available data has been used.

[*] Pune, Nashik, Nagpur, Pen, Vashi, Vasai, Jalgaon, Bhandup, Aurangabad, Kalyan, Akola, Kolhapur and Ratnagiri.

Data integrity

3.2.6 Data integrity refers to the completeness, accuracy and relevance of the data in the system. Existence of adequate controls is necessary to ensure data integrity. A control is a system that prevents, detects and/or corrects unlawful events. An unlawful event can occur if unauthorised, inaccurate, incomplete, redundant, ineffective or inefficient input enters the system. An unlawful event can also arise if the system transforms the input in an unauthorised, inaccurate, incomplete, redundant, ineffective or inefficient manner. Audit tested the LT billing system for existence and adequacy of management controls, input controls and processing controls. Deficiencies noticed are discussed in the following paragraphs.

Management controls

Lacunae in change management control

3.2.7 Change management control refers to controls to be exercised in carrying out changes to the system. It *inter-alia*, covers authorisation for changes to the system to incorporate tariff changes and for effecting improvement in the system, monitoring progress in making such changes to the system, use of systematic approach to program design, documentation standards to ensure that program can be easily read and understood and testing of program *etc*.

There was no documented delineation of duties and responsibilities for modifications to the system.

Changes in tariff have a significant bearing on revenue. A proper documentation of changes made to the system is necessary so that the same could be readily understood and to facilitate further modification as and when necessary. Audit scrutiny revealed that there was no formal documentation procedure describing the manner in which changes made to the program are to be documented such as record of program code, use of charts to show the structure of program in terms of its major components and the relationships among these components, flow of logic in calculation of various charges.

The Board stated (August 2005) that minute details of changes would be maintained.

In view of the mission critical nature of the system it is essential that modifications to the system to incorporate changes in tariff are tested to ensure that the bills generated are in accordance with the tariff rules. Further the changes should be formally accepted by the commercial section before implementation. Testing of modifications to programs was done using test data. It was, however, observed during audit that there was no documented testing methodology indicating the basis for selecting test data. Sample bills for major changes were generated and sent to the commercial section, but there was no system of obtaining formal acceptance to the changes made to the system from the Commercial section.

The Board stated (August 2005) that a system is being put in place to obtain formal acceptance from commercial section. Absence of effective control measures for changes to the system and testing of modification to programs necessitated multiple revisions to the program. As seen from **Annexure–10** amendments to rectify the deficiencies in implementation of tariff revision of January 2002 continued up to October 2003. Likewise there was delay in correct implementation of the tariff order of December 2003. Such belated revisions giving effect from prospective dates was detrimental to the Board's interest.

The Board stated (August 2005) that though in some cases amendments were issued prospectively instructions were issued to re-process wherever possible. It was further stated that where re-processing involved more steps to be carried out, programs were issued to generate adjustments without the need to carry out entire re-processing. During local inspection by audit the departmental staff failed to produce the documents in support of reprocessing being done systematically wherever amendments were issued with prospective date.

Audit trail for control over modifications to the system was lacking.

Modifications to the program were sent as amendments to IT centres. Though amendments were sequentially numbered, it was observed during audit that there were several version changes to one amendment, which were sent under original amendment numbers. In the absence of system of feedback from IT centres there was no effective control to ensure that the latest version of a particular amendment was sent to IT centres and actually incorporated by each IT centre.

The Board stated (August 2005) that for effective version control latest software tools in the market would be used. The reply is not relevant as the audit observation is not about latest software tools not being used but a system in place to ensure that latest version of amendments was incorporated.

Input controls

3.2.8 Input to the LT billing system comprises data and instructions for processing. Data entry is done manually via keyboard through private agencies. Effective control over both these types of inputs is critical as they involve considerable human intervention and are, therefore, error prone and susceptible to fraud.

Absence of effective control over energy consumption data

3.2.9 A meter provided by the Board at the consumer's premises records energy consumed by the consumer. Periodical meter reading is done by a meter reader and details thereof are entered in the LT billing system. As the meter reading is vital for accurate computation of the energy bill, adequate control should be exercised to ensure its accuracy. This could be done in two ways *viz*. periodical test check of meter reading by an authority other than the meter reader or identification of abnormally lower or higher readings *vis-a-vis* pre defined parameters while processing the bills.

There was no monitoring mechanism to ensure test check of meter readings as per quantum prescribed.

The Board's rules provide for test check of meter readings (5 *per cent* of first 1,000 consumers and two *per cent* of remaining consumer) by sectional heads and one *per cent* of consumers by sub divisional officer. The sub divisional officer is responsible for comparing the meter readings as provided by meter reader with the reading obtained during test check and to take appropriate action in case of any variation. The LT billing system does not, however, provide for monitoring whether the sub divisional officer has carried out the prescribed quantum of checking.

The Board stated (August 2005) that test readings taken by authorities higher than the meter reader are considered for billing purpose. The reply does not answer the specific issue of monitoring the system of prescribed quantum of checking by higher authorities in respect of meter reading.

In the absence of effective control over data relating to energy consumption data integrity is not ensured.

Processing controls

3.2.10 Processing of bills in the LT billing system at IT centres involves operations such as validation of data received from the billing units, updation of master records, performing calculations and generation of bills. The following deficiencies were observed during audit:

Absence of monitoring mechanism for rectification of errors

3.2.11 Error reports covering about 30 types of errors such as consumer number/meter details not available in master, data relating to change of meter not updated *etc*. are generated through the LT billing system and furnished to billing units for rectification before generation of bills. It was, however, observed that there was no mechanism to monitor the rectification. An illustrative list of cases of errors not rectified in respect of one billing unit is given below:

Error message	Remarks
Details of change in meter not updated.	Till the details of changed meter are fed, billing is done on average basis instead of recorded consumption.
Mismatch between meter identification code and tariff code.	The first two digits of meter number indicate the category of consumer. This should tally with the tariff code for which a separate field is provided. In case of mismatch the same needs to be investigated since billing will be erroneous if the tariff code is wrong.
Permanently disconnected consumers having meter	This indicates that the report of meter disconnection in respect of permanently disconnected consumer has not been fed into the system. There is a need to investigate and take action to remove the meter.

Mere reporting of errors without a suitable mechanism for ensuring rectification renders the validation checks ineffective.

The Board stated (August 2005) that if the errors reported in billing are not attended, the errors are reported again till rectified. The reply is not acceptable. There is a need to have a proper monitoring mechanism so that the errors are rectified immediately when brought to notice.

Flaws in programming logic

There were flaws in programming logic leading to incorrect computation of bill.

3.2.12 Accuracy in programming logic is essential to ensure that the bills generated are in accordance with the terms and conditions of the tariff. Audit scrutiny revealed the following flaws in programming logic leading to incorrect computation of bills:

Defect in programming logic for computation of energy charges

There was short recovery of energy charges due to non adjustment of slabs for bill period less than 30 days.

3.2.13 As per the Board's tariff, energy charges are recoverable at rates per unit prescribed for each slab of consumption. The slabs are prescribed for a period of one month consisting of 30 days.

While there were *pro-rata* changes in the slabs for bill periods exceeding 30 days there was no downward adjustment when the bill period was less than 30 days. The short recovery noticed in audit was Rs.30.93 crore from 28.55 lakh consumers.

The Board stated (August 2005) that the matter had been referred to the commercial section for taking necessary action on the audit observation.

Flaw in programming logic for billing for the month when faulty meter is replaced

3.2.14 A meter is changed when it is faulty. The principle as incorporated in the system for calculation of energy chargeable for the month in which a meter is replaced was found to have a flaw. Energy is billed only for the consumption from the date of replacement of the meter to the last date of the billing period. The period from the start of the billing period to the date of replacement also ought to be charged on the basis of average consumption by the program but this is not being done. An illustrative case is given below:

Particulars	Bill details
IT centre and billing unit	Vashi IT centre
Consumer number	000228090891
Meter replacement date	13 April 2005
Bill period	02 March 2005 to 03 May 2005
Consumption after installation of new meter (units)	143 (13 April 2005 to 3 May 2005)
Units billed	143
Period for which not billed	02 March 2005 to 13 April 2005 (42 days)
Units short billed	160 (based on average consumption of 228 units for two months)

The Board stated (August 2005) that the matter had been referred to the Commercial section for taking necessary action on the audit observation.

Effectiveness of LT billing system

3.2.15 Effectiveness of LT billing system depends on its ability to enable the Board to achieve the objectives for which the system was introduced. Audit examined the LT billing system to determine the extent to which the system enabled the Board in achieving its main objectives to reduce time lag in issue of bills, to provide accurate billing and accounting information, to collect shortfall in security deposit and to initiate follow up action for recovery of dues. The shortfalls in achievement of objectives are discussed below:

Delay in processing of bills

3.2.16 The norm fixed for generation of bills is 12 days from the date of meter reading. Early issue of bills to the consumers would result in early realisation of revenue. It was observed in audit that there were delays in processing of bills beyond the prescribed period of 12 days in respect of 8,835 processing cycles (bill amount: Rs.15,630.09 crore) and in some cases the delays were as high as 91 days. Thus, one of the main objectives of the LT billing system *i.e.* timely issue of bills has not been achieved. There was no effective mechanism to record the actual time taken for each stage of operation, identify and analyse delays in each operation and to take appropriate remedial measures.

There was no effective mechanism to monitor delays in processing of bills for remedial action.

As per the Board's conditions of supply, time allowed for payment by consumers is 20 and 30 days from the issue of monthly/bi-monthly and quarterly bills respectively. It was observed in audit that the billing units arbitrarily decided the due date for payment of bills without ensuring that the consumers were given the full benefit of prescribed period for payment; the period allowed for payment was only one to 18 days in the bills issued for 15,584 processing cycles.

Consumers were denied the full benefit of prescribed period for payment.

The Board stated (August 2005) that the billing units decide the due dates. The reply is not tenable. There is a need to ensure that the consumers get the benefit of full period prescribed for payment.

The first bill of a newly connected consumer is required to be issued in the next billing cycle after the release of a new connection. Audit scrutiny revealed that out of 4.69 lakh first bills issued, 2.51 lakh bills (54 *per cent*) were issued after delays of 63 to 202 days, which resulted in loss of interest of Rs. 3.21 crore[#]. There was no mechanism to monitor delays in issue of first bills. There was also no system of reporting such delays for fixing responsibility and to take action against the officials concerned.

There was no monitoring mechanism to identify delays in issuance of first bills and to fix responsibility.

[#]Computed at 11 *per cent* being the average of cash credit rate of interest for the period from 2001-05.

The Board stated (August 2005) that the delay in issue of first bill was due to delay in feeding the data into the computer system. There is a need to ensure monitoring in issue of first bills so that the delay is avoided.

Shortfall in collecting security deposit

3.2.17 The Board's tariff and conditions of supply stipulate recovery of security deposit equivalent to average amount of energy bills for three months or for one billing cycle (monthly, bi-monthly *etc*.) whichever is less. Every year, in the month of March, the security deposit available *vis-a-vis* average amount of energy bill for one billing cycle based on billing for one year was to be reviewed and any shortfall in required security deposit was to be demanded from the consumer. This was not being done. Audit analysis revealed that the shortfall in security deposit collected as on 31 March 2004 was Rs.840.72 crore from 47.85 lakh consumers. Adequate security deposit was essential to safeguard the Board's interest in the event of non payment of dues by the consumer. Therefore, demand for shortfall in security deposit should be automatically generated and issued to the consumers without fail.

The low tension billing system did not ensure that security deposit was adequate.

The Board stated (August 2005) that guidelines had been issued to field offices to generate additional security deposit bills. The reply is not acceptable. The large shortfall in security deposit as pointed out above is a clear indication that the guidelines were not followed.

Low tension billing system not being effectively used for monitoring recovery of dues

3.2.18 One of the main objectives of the LT billing system is to initiate prompt follow up action in case of non payment of energy bills. Follow up action comprises temporary disconnection, permanent disconnection and legal action for recovery. The system generates reports of consumers whose connections are liable for disconnection for non payment of dues and the same is provided to the billing units. It was observed in audit that there was no reporting mechanism for identifying disconnections not carried out and the number of months for which action for disconnection was pending and to report the same to higher authorities for fixing responsibility. It was further observed that there was no procedure to feed into the LT billing system the details regarding date of filing suit for recovery, status of suit filed, date of decree obtained, amount for which decree obtained, date of filing decree for execution, date of recovery, amount recovered, reasons for not being able to obtain decree or not being able to recover decreed amount and amount written off. The aggregate dues (March 2005) from permanently disconnected consumers amounted to Rs.900.23 crore from 11.29 lakh consumers, of which, Rs.266.64 crore were due for more than three years from 3.56 lakh consumers. Effective control mechanism to monitor follow up action for recovery through the LT billing system was lacking as was evident from the increase in arrears from Rs.2,760 crore in 1999-2000 to Rs.5,388.78 crore in 2003-04.

Effective control mechanism to monitor follow up action for recovery was lacking.

The Board stated (August 2005) that reports are generated for the purpose of monitoring. The reply is not acceptable. The monitoring mechanism was ineffective as detailed above.

Low tension billing system though critical in nature not reviewed by internal audit

3.2.19 LT billing being mission critical in nature needed the attention of the Internal Audit wing. The Internal Audit had, however, not audited the LT billing system.

The Board stated (August 2005) that the LT billing system was being audited at the time of inspection of field offices. The reply is not acceptable as the present inspection did not cover audit of LT billing using COBIT frame work or similar acceptable methodology.

Conclusion

The low tension billing system installed by the Board did not have effective management controls such as separation of duties and change management controls. There were several deficiencies in input controls and processing controls in the system. Consequently, the system failed to ensure data integrity. Lack of effective controls resulted in generation of erroneous bills and non recovery of dues thus failing to safeguard the Board's assets. The system was not effective in achieving the Board's objectives of computerising the LT billing operations.

Recommendations:

- **There is a need to have a system in place providing for detailed documentation to ensure that re-processing is carried out without fail.**
- **There is a need to investigate mismatch between meter identification code and tariff code and take action to rectify the deficiencies.**
- **Demand for shortfall in security deposit should be automatically generated and issued to the consumer without fail.**

The matter was reported to the Government (March 2005); the reply had not been received (December 2005).