

3.2 INFORMATION TECHNOLOGY REVIEW ON IMPLEMENTATION OF SOFTWARE ON HIGH TENSION REVENUE BILLING

HIGHLIGHTS

The software for High Tension billing in all the 37 Electricity Distribution Circles of Tamil Nadu Electricity Board which was introduced in July 2001 did not cover all the essential items of revenue to be assessed. The vendors failed to provide module for online collection and integrate it with the accounting system as per the terms of contract.

(Paragraphs 3.2.1 and 3.2.4)

The program did not levy maximum demand charges based on recorded maximum demand resulting in short levy of Rs.28.21 lakh .

(Paragraph 3.2.9)

The program incorrectly worked out Additional Current Consumption Deposit (ACCD) in respect of leasehold services, which had to be corrected manually.

(Paragraph 3.2.21)

The program did not ensure compliance with energy audit regulations resulting in non-recovery of penal charges of Rs.33.29 lakh.

(Paragraph 3.2.25)

The periodical amendments to the program were not systematically maintained in the program library. Ensuring that the amendments were authorised, tested and accepted was therefore not possible.

(Paragraph 3.2.27)

Introduction

3.2.1 Tamil Nadu Electricity Board (Board), a statutory body, was formed in 1957 under the Electricity (Supply) Act, 1948 to take up the role of the erstwhile Electricity Department of the Government of Chennai. The main functions of the Board are to generate, transmit and distribute power in the State of Tamil Nadu and to wheel power to a part of the Union Territory of Pondicherry under mutual agreement. The distribution of electricity is being done through 37 Electricity Distribution Circles (EDCs) spread over the State. The revenue generated by the Board through High Tension (HT) services by these EDCs for the financial year ending 31 March, 2003 was at Rs.4,452.63 crore representing 47.9 *per cent* of the total revenue.

The program for HT billing was made in COBOL in the initial stages, which was converted in FoxPro in the early nineties. Later, to take advantage of the developments in Information Technology (IT), the Board switched over to Oracle RDBMS (Relational Database Management System). This application was introduced in July 2001 in all the 37 EDCs.

Audit scope and methodology

3.2.2 The software aimed at (a) preparation of HT bills (b) online collection and accounting (c) analysis of the consumption pattern, and (d) attainment of complete revenue realisation. The objective of audit was to examine whether the aims were achieved, to evaluate IT controls to ensure their adequacy and to ensure that the relevant business rules, terms and conditions of supply of electricity and periodical operational instructions have been correctly embedded in the software.

The scope of audit involved a review of the system and connected records in Headquarters of the Board and a test check of the relevant records in five EDCs (South, Central, North and West of Chennai and Tirunelveli). The EDCs selected for audit accounted for 27.3 *per cent* of the total revenue of Rs.4,452.63 crore from HT services as on 31 March 2003. The data maintained in the central server for the period upto October 2003 was queried using Structured Query Language (SQL). Wherever necessary, the reports generated by the systems were also used for analysis. The results of the queries were examined to evaluate the adequacy of IT controls, to identify loss/omission of revenue and to ensure comprehensiveness of the software. The audit findings are discussed in subsequent paragraphs.

Software development and implementation

3.2.3 The order for the design and development of software for computerization of H.T Billing and collection of Current Consumption charges was awarded in April 2000 to Broadline Computers Pvt Ltd, Chennai for a total fee of Rs.18.16 lakh. The billing software including modules for Security Deposit, HT

application and integration with accounting system was to be completed within six months from the date of award of the Purchase Order (P.O) i.e by October 2000. The software was, however, implemented in all the circles with effect from July 2001 only.

3.2.4 Audit observed that:

- * The online collection module was not implemented.
- * The module did not handle various billing components such as banking charges and Reactive Kilovolt Ampere hour (RKVAHr) penal charges for windmill services and energy audit regulations.
- * The billing software was not integrated with the accounting system.
- * The Board continued with the manual system of writing of consumer ledgers resulting in duplication of work and ineffective deployment of manpower and other resources.

The Board stated (November 2003) that the module to computerise all types of collections was developed and implemented in EDC Chennai (North), from December 2002 and in EDC, Vellore, from August 2003. The remaining circles were instructed to implement the same from November 2003. For the delay, it was stated (May 2004) that a sum of Rs.0.30 lakh was deducted as liquidated damages. The Board, however, could not complete the planned computerisation within the time frame.

Deficiencies in system design

The data analysis using SQL, to verify whether the business rules have been incorporated in the application, revealed the following deficiencies in the system design:

3.2.5 The EDCs have to periodically transfer data to the central server as per the following detailed schedule:-

- * Every day during the billing time i.e at the month end;
- * At the end of the collection due date;
- * 25th of the collection month;
- * 31st of the collection month and
- * Final transfer of the data on 5th of the subsequent month of collection month.

However, no program control existed to ensure that the EDCs transmitted the complete processed data as per the prescribed schedule. No records were also available in the computer centre for having sent reminders immediately after the due dates to the EDCs for transmitting the unsent data.

3.2.6 The software generated a low consumption report in EDCs, for the services reporting a drop of 20 per cent and above in the consumption as compared to previous month, for investigating the reasons therefor. The report generated in respect of HT services (having windmill units elsewhere in the State and exported windmill generation into TNEB lines), however, did not exactly reflect the low consumption as the electricity exported by windmills into TNEB lines as reduced by transmission charges was adjusted against the units to be billed under HT service. The gross consumption to be billed under HT services was, therefore, reduced to the extent of units exported by windmill units. If windmill export was more than the consumption of units by the HT service, no consumption would be billed for. The low consumption report was, however, prepared for the consumption after adjusting units exported by windmill units, instead of comparing the consumption of gross units consumed by the HT service alone. The Board stated (May 2004) that the software was corrected to consider gross consumption to correctly reflect the trend in consumption.

3.2.7 The meter reading of the windmill units was taken periodically by the EDCs where the units are situated and reported to the EDCs concerned where the HT services of the windmill units were located. The reading details were processed manually by the windmill EDCs and were transmitted by post/e-mail to the EDCs of the HT services concerned for adjustment of the same in the regular energy bills. The information so received by the EDCs of the HT services concerned was again processed for entering into the system. As all the servers in the EDCs were connected to the central server, the monthly meter-reading details in respect of all windmill units could have been directly entered by the respective EDCs where the windmill units were located. This effective data entry procedure avoids double data entry, delay and errors in transmission of information. The Board agreed (May 2004) to incorporate the suggestion made by audit in the software after detailed study.

3.2.8 The regular meter reading for an HT service was taken at the end of every month. A test check of data in the central server indicated more than one regular meter reading for a particular HT service. The Board stated (May 2004) that the program was modified to reject multiple records for regular meter reading.

Deficiencies in billing module

Calculation of Maximum Demand charges

3.2.9 The Maximum Demand (MD) in a month is the highest value of the average Kilovolt-amperes delivered at the point of supply of the consumer during any consecutive thirty minutes in the month and is expressed in KVA. As per the

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terms and conditions of supply of electricity, if an HT service exceeds the contracted load in a month, additional charges at two times the demand charges have to be levied for the MD exceeding the contracted load. Due to tariff change with effect from 16 March 2003, two readings (one on 16 March 2003 and the other at the end of March 2003) were taken in March 2003. The program, however, worked out MD based on average recorded MD in the two readings and billed accordingly. As a result, the billed MD was lesser than the MD recorded during the month of March 2003 in respect of 149 services. The program, thus, violated the business rule to bill for the maximum MD recorded during a month. This resulted in shortfall in assessment of Rs.22.89 lakh in respect of 114 industrial and commercial services in 26 EDCs. Similarly, in respect of 35 tariff II services, short levy worked out to Rs.5.32 lakh. The Board accepted (May 2004) the above finding and intimated that the short assessment in MD was reworked out and collected.

3.2.10 The monthly recorded MD has to be rounded off to two decimal places and billed for at a fixed rate per MD. Audit observed that, in 2003, the billed MD was incorrectly rounded off by the program in respect of 11 services. The Board stated (May 2004) that the calculation to arrive at the recorded MD to two decimal places was changed.

Working of power factor

3.2.11 Power factor is the ratio of the real power to the apparent power. As per the tariff revision with effect from 16 March 2003, the Board introduced a power factor rebate at 0.5 *per cent* of the amount of current consumption charges for every increase of 0.01 in power factor above 0.95. Though the incentive scheme was to be worked out taking into account the Kilowatt hour (kwhr) and Kilovolt ampere hour (kvahr) consumption with effect from 16 March 2003 to the end of March 2003, the program had, however, worked out the power factor for the entire month of March, 2003. Due to the above method adopted by the Board to reckon power factor, the incentive allowed to 425 HT consumers was incorrect leading to an excess rebate of Rs.5.65 lakh and in addition, a penalty of Rs.4.64 lakh was also to be recovered from 21 HT consumers out of the above 425 consumers. The Board stated (May 2004) that the power factor was reworked out and intimated to the circles to collect the excess incentive allowed.

3.2.12 The power factor, in respect of some cases, was estimated on average basis considering parameters relating to previous months. A test check of the relevant data for April to October 2003 revealed that in certain cases, when the power factor exceeded one, the program erroneously reckoned it as zero instead of restricting it to one. The Board stated (May 2004) that the program was modified in February 2004.

3.2.13 A review of the power factor worked out on average basis during January to November 2003 also indicated that in two out of 41 cases, average kvahr, one of the two parameters required for arriving at the power factor, was not entered

but the power factor value was found in the record. It indicated that the program allowed manual entry of power factor, which was otherwise to be processed through program. The Board stated (May 2004) that the program was modified to calculate the power factor as zero if one of the parameter was not entered.

3.2.14 The HT services have to maintain power factor of their installation at not less than 0.9 as per March 1994 gazette. In the event of the average power factor going below 0.9 consecutively for three months, in addition to the levy of compensation charges, the service connection has to be disconnected giving seven days' notice to the consumer. The service connection was to be reconnected only after the power factor correction was carried out.

]An analysis of the data on low power factor during April to November 2003 indicated that in respect of 91 services, though the power factor was below 0.90 consecutively for three months, the services were not disconnected to improve the power factor. It indicated that the control failures at the EDC level have not been systematically reported to the competent authority, despite the availability of such information in the central server. The Board noted down the point and agreed (May 2004) to incorporate a module to generate a monthly report for review.

Non-regulation of banking charges of wind mills

3.2.15 As per the Board Proceedings (Finance Branch) No.99 dated 27 September 2001, if the energy generated by the windmill units in a month is surplus after adjusting with the energy consumed by the respective HT services, the surplus energy can be carried forward and adjusted in the ensuing months upto the end of 31 March of every year. The Board has to recover five *per cent* of the units carried forward as banking charges. The program did not, however, have a module to deal with banking charges. A test check of banking charges details in respect of four HT services in EDC Chennai (South) and in five HT services in Chennai (Central) revealed that the banking charges were either not deducted or worked out incorrectly resulting in a loss of revenue of Rs.10.30 lakh. The Board stated (May 2004) that a module was incorporated in the program for banking charges.

Absence of module to deal with banking charges for windmill units resulted in loss of revenue of Rs.10.30 lakh.

Continuance of minimum billing beyond the admissible period

3.2.16 As per clause 13.06 of the terms and conditions of supply of electricity, a service may be temporarily disconnected and minimum demand charges billed for a total period of six months for non-payment of dues. A test check of data from April 2001 to October 2003 revealed that in respect of 159 cases, the services were kept disconnected temporarily for more than six months. The program was not able to detect cases in which the services were kept temporarily disconnected beyond a continuous period of six months. The Board stated (May 2004) that the point was already noted and incorporated in the package in December, 2003.

Deficiencies in Security Deposit module

As per clause 6.05 of the terms and conditions of supply of electricity of the Board, the Initial Current Consumption Deposit (ICCD) payable by the intending consumer who was not the owner of the premises, was double the normal rate of the Current Consumption Deposit (CCD) payable by the consumer in the normal course. Additional Current Consumption Deposit (ACCD) reviewed and refixed every year (at 1.5 times the average of the current consumption charges for the preceding twelve months prior to the month of April of that year) has to be maintained at a value not less than ICCD. Audit observed the following deficiencies in security deposit module:

3.2.17 Data analysis in EDC Chennai (North) for 2002-03 indicated that in respect of 40 services, the average monthly current consumption charges were incorrectly worked out at Rs.2.26 crore in place of Rs.2.83 crore by the program. The figures were corrected manually.

3.2.18 ACCD in respect of 23 HT services indicated negative balance of Rs.32.89 lakh during 2001-02. The Board stated (May 2004) that the program was suitably modified to remove negative balances.

3.2.19 In security deposit module, one of the columns representing the instalment amount of ACCD received from the consumers for the year 2002-03 exceeded the allowable size and consequent thereto, the values in respect of six EDCs could not be read. The Board stated (May 2004) that the problem was set right.

3.2.20 The Security Deposit information such as ICCD, ACCD, and Excess Current Consumption Deposit contained more than one record for a particular HT service. Out of the total records of 6554 and 6806 for 2001-02 and 2002-03, only 1328 and 1369 records respectively were maintained correctly without any duplication. The Board stated (May 2004) that initially records were maintained for storing opening balance of Security Deposit and ACCD separately and later, they modified it to have one record per service.

3.2.21 A test check of CCD statement of EDC Chennai (South) for 2002-03 revealed that in respect of six leasehold services, the program worked out ACCD adopting the terms and conditions applicable for a regular HT service. As against a sum of Rs.90.53 lakh to be collected as ACCD, the program worked out the same as Rs.45.24 lakh. ACCD assessment in such cases was corrected manually. As leasehold services have not been specifically dealt with in the module, there is risk that the security deposits for such cases might be under-assessed or refund of security deposits processed incorrectly in various EDCs. The Board agreed (May 2004) to incorporate the above aspect suitably in the program.

The program incorrectly worked out ACCD in respect of leasehold services, which was corrected manually.

Deficiencies in HT application module

In order to effect improvements in processing HT applications and customer service, the Board prescribed (December 2000) a maximum time of 120 days for effecting supply from the date of agreement with the consumer. An analysis of the data maintained in the server in the HT application module indicated the following:-

3.2.22 As per the data received from the EDCs to the server, 157 applications for HT services were pending as on 27 November 2003. As against the maximum time prescribed for final disposal of HT applications, the pendency exceeded one year in respect of 33 applications and two years in respect of 13 applications. The reasons for delay in these applications could not be found from the data in the absence of a column to that effect.

3.2.23 On readiness of supply, the Board has to issue notice to the consumers to avail of the supply within three months and for that period, monthly minimum charges have to be levied for the sanctioned load for the number of days from the date of issue of notice. Audit observed that the billing software did not ensure that monthly minimum charges were duly levied. A test check of the records in two EDCs in Chennai revealed that in eight cases, monthly minimum charges of Rs.30.03 lakh (from the date of serving notice to avail supply within three months) were either not levied or completely collected.

3.2.24 A time extension for a further period upto three months beyond the notice period of three months has to be granted by the Regional Chief Engineer (RCE) concerned, by collecting the monthly minimum charges for the entire period of six months. But, in two out of eight cases mentioned above, at the time of granting second extension by the RCE, the charges were not collected as mentioned above indicating violation of the relevant business rule.

Absence of module to implement provisions of Energy audit

3.2.25 Consequent to the Government of Tamil Nadu's G.O Ms.No.72 dated 10 May 1996, energy audit was made mandatory for every HT industrial and commercial service and the terms and conditions of supply of electricity was amended (March 1997) accordingly with the objective of minimizing energy costs/consumption. Every HT consumer has to complete energy audit and submit the report thereon within 180 days from the date of receipt of notice issued by the Board in this regard. On expiry of the above period of 180 days, defaulters are issued notice of warning to submit the report within 90 days. Though the statutory regulation relating to energy audit was incorporated in the terms and conditions of the Board, the software did not provide a module to monitor whether energy audit regulations were fully complied with by the services and in the event of default, punitive measures were systematically initiated and appropriate penal charges levied.

The program did not ensure compliance with energy audit regulations resulting in non-recovery of penal charges of Rs.33.29 lakh.

A review of the records maintained in three EDCs in Chennai (South, West and North) revealed that the Board failed to impose a penalty of Rs.33.29 lakh in respect of seven HT services that had not submitted energy audit reports even after expiry of the warning period of three months. Besides, the details of new services (on completion of three years) required to conduct energy audit have not been systematically identified and notices issued on a regular and on-going basis. The Board stated (May 2004) that the point was noted and incorporated in the package.

Review of the incentive schemes

3.2.26 The concession of higher power factor with effect from 16 March 2003 and reduction of five *per cent* charges of night hour consumption were aimed at improving the line voltage which could benefit to the Board in terms of minimisation of shut downs and improving transmission voltage. A review of the quantum of benefits extended under the incentive schemes revealed that during March to October 2003, the concession for night hour consumption and high power factor (power factor above 0.95) allowed were Rs.25.06 crore and Rs.33.99 crore respectively. The Board failed to comprehensively review the package of concessions vis-à-vis the technical and commercial benefits to the Board to propose appropriate corrective action and to maintain revenue as per the budgeted projections. It is also relevant to point out that the Board, while reviewing the performance for the half-year ended October 2003, observed that one of the reasons for short fall in pro-rata revenue realisation was concessions such as power factor incentive, rebate for night hour consumption, etc. The Board stated (May 2004) that the finance wing did conduct the review. However, no report in this regard was available for having reviewed the schemes in detail from the records produced to audit.

Deficiencies in change Management Controls

Any application system requires a sound change management procedure covering control of the ongoing maintenance of the system, standard methodology for receiving and performing changes. A number of deficiencies in change management controls were noticed during audit which are detailed below:

3.2.27 The program requires amendments as per change in business rules and due to improvements effected in the software. For different versions of the program released periodically, subsequent to July 2001, a master copy of the same had not been, however, maintained in program library to ensure that the amendments to the software were authorised, tested and accepted.

3.2.28 The history of program amendments indicating briefly the reasons for effecting changes in the program, the modules affected, the effective date from which it was put into use and the test results of the program were not kept for reference and record. The details of the operating version of the program were also not maintained.

3.2.29 The various components of the program and the relationship among these components had not been documented to identify and reduce errors in the source code.

3.2.30 The programs released were not thoroughly tested before they were put into use in the EDCs. The program worked out (August 2001) the bill amount in respect of few services wrongly despite entering of correct data. The vendor's acceptance of the above lapse in thoroughly testing the program indicated that the program was not fully tested before its use.

3.2.31 A test check of security deposit assessment in respect of EDC Chennai (North), revealed that the computer generated security deposit figures were replaced by the EDC to arrive at the correct security deposit figures. It indicated that data amendments in the EDC had not been done with prior authorisations. Neither the EDC formally communicated the data amendments to the computer centre nor the server detected such amendments through the program.

The Board stated (May 2004) that the observations were noted for future guidance.

Conclusion

The application, which was implemented after a delay of eight months, contained various design deficiencies and a number of billing components were left beyond the scope of the software. Deficiencies in change management controls were also observed during audit.

The organisation needs a systematic documentation of all amendments made to the software and bring all aspects of HT billing under the application. The application should have a module on energy audit provisions so that compliance thereto is monitored through the program and punitive measures are systematically initiated. The Board could use the information generated through the computerised system periodically to review the effectiveness of incentive schemes.