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Working Paper:

Billing and Collection Strategies for NEPA

Submitted by

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SECTION 1 INTRODUCTION

1.1 BACKGROUND

USAID has contracted Nexant to provide technical assistance to the National Electric Power Authority (NEPA) on corporate restructuring. The objectives of the USAID program are to implement market-based reforms and attract private sector participation.

A component of the project addresses re-engineering core processes at the distribution and marketing divisions to instill commercial practices and create functionally independent DisCos to operate within the new market. This report presents the consultants' findings on retail billing and collections.

The recommendations in this report have been developed based on discussions with NEPA Executive Directors, field managers, RCM contractors and HQ staff. Abuja Zone organized several key field trips and meetings for the consultants to better understand the situation on the ground.

1.2 OVERVIEW OF BILLING AND COLLECTIONS

The majority of what a power utility does is not visible to its customers; but the bill is one of the few areas in which a sustained level of contact can be maintained and relationships cultivated with all categories of customers. The monthly (or bi-monthly or fortnightly) bill is a valuable means of communicating with each customer on a regular basis. Delivering an accurate, timely and informative bill in a cost-effective manner is the nucleus of the customer care operation. For this reason, billing is becoming the heart of a customer management process. It is also an area in which cost efficiencies result in significant revenue generation. How to build new systems, integrate multiple billing and remittance operations across multiple service areas and develop opportunities for marketing additional products and services are fundamental business process decisions continually faced by utilities.

An Integrated approach to meter reading, billing, collection and IT is required to drive revenue potential, service consistency and customer loyalty. Good technology management can help utilities to integrate meter reading, billing and customer service and link it seamlessly with work management, field service and other vital functions economically and reliably and introduce new systems and operating models across the revenue cycle. It is of vital importance in the changing business environments of regulatory regime that demands higher performance standards.

The billing and collection process in NEPA have lot scope for improvement and this paper examines the basic issues and recommends some key decisions that NEPA can implement with minor investments which will bring about remarkable improvements in the entire revenue cycle management. Also the report contains the recommended minimum features for a new billing and cash management software.

1.3 CONTENTS OF REPORT

This report covers the following areas:

- Section 2: Diagnosis of the Revenue Cycle – Reviews NEPA procedures for billing and collections in the field divisions, and summarizes the main problem areas.
- Section 3: Recommendations – Provides recommendations to address the main problem areas in billing and collections.
- Section 4: Features of Modern Billing Software – Provides a sample TOR that can be used for recruiting consultants for management contracts.
- Appendix A: Examples of Modern Billing Software Packages – Provides summary descriptions of three modern customer billing software products from venders Tata, Wipro and Geneva.

SECTION 2 DIAGNOSIS OF THE REVENUE CYCLE

Revenue cycle management at NEPA is inefficient for a variety of reasons. NEPA has initiated several measures to improve the situation. A key initiative is the appointment of eight Revenue Cycle Management (RCM) Contractors covering sixteen districts. The introduction of private RCM Contractors has improved somewhat the billing and collection efficiency. However due to inherent problems in NEPA such as lack of meters, faulty meters, inaccurate customer information, outdated billing software etc (which are beyond the scope of the RCM contracts) the overall efficiency of revenue cycle management in NEPA continues to be far from satisfactory.

The billing process in NEPA involves several steps that can be eliminated. Although the process deploys high-end computer systems it fails to deliver real value to the operation.

This section provides 1) a description of how the revenue cycle works at present and 2) a diagnosis of key problem areas. The next section provides recommendations to address the identified problem areas.

2.1 ORGANIZATION OF MARKETING FUNCTIONS

The Marketing Sector within NEPA is responsible for billing and collections. The key departments involved in billing and collection and their roles are described below.

2.1.1 Customer Service Centers

The customer service centers maintain the meter folio of the customers. These are printed formats bound together for each area in folders (Form NEPA 177A – for residential customers, 177B- for commercial customers). The Meter Reader carries the folio to the customer's premises and update the meter readings. The meter folios have no backup. As new customers are added in each area, their folios are inserted in the respective books. The Meter Reader enters the consumption of each customer during the billing cycle in the Reading Sheet (sent to Service Centers from the District Computer Center). This Reading Sheet is sent to the District Computer Center through a representative of the Service Center.

Customer Service Center also sends the data of new customers added in each month to the Computer Center.

2.1.2 District Computer Center

The reception unit of the Computer Center receives the Reading Sheets, assigns batch numbers and forwards to the Data Entry unit, where the readings are entered in the "meter activity menu" of the billing software. After data entry, they take a printout of the updated meter readings. This printout and the Reading Sheets that came from the Service Center are sent to the Data Control unit in the computer center, where the output (printout) is compared with the data in the Reading Sheets. This operation is done manually. The past payment details are also checked at Data Control from the payment stubs they receive from the District Accounts office.

Errors (if any) are marked on the hard copy of the output (printout) and send back to Data Entry for final corrections. After the corrections are incorporated, the input files are transferred (electronically) to the Operation unit in the Computer Center, where Bills are generated and printouts taken.

Representatives from Service Centers come to collect the printed bills. Usually the Reading Sheets for the next billing cycle is also issued at the same time to the Service Center.

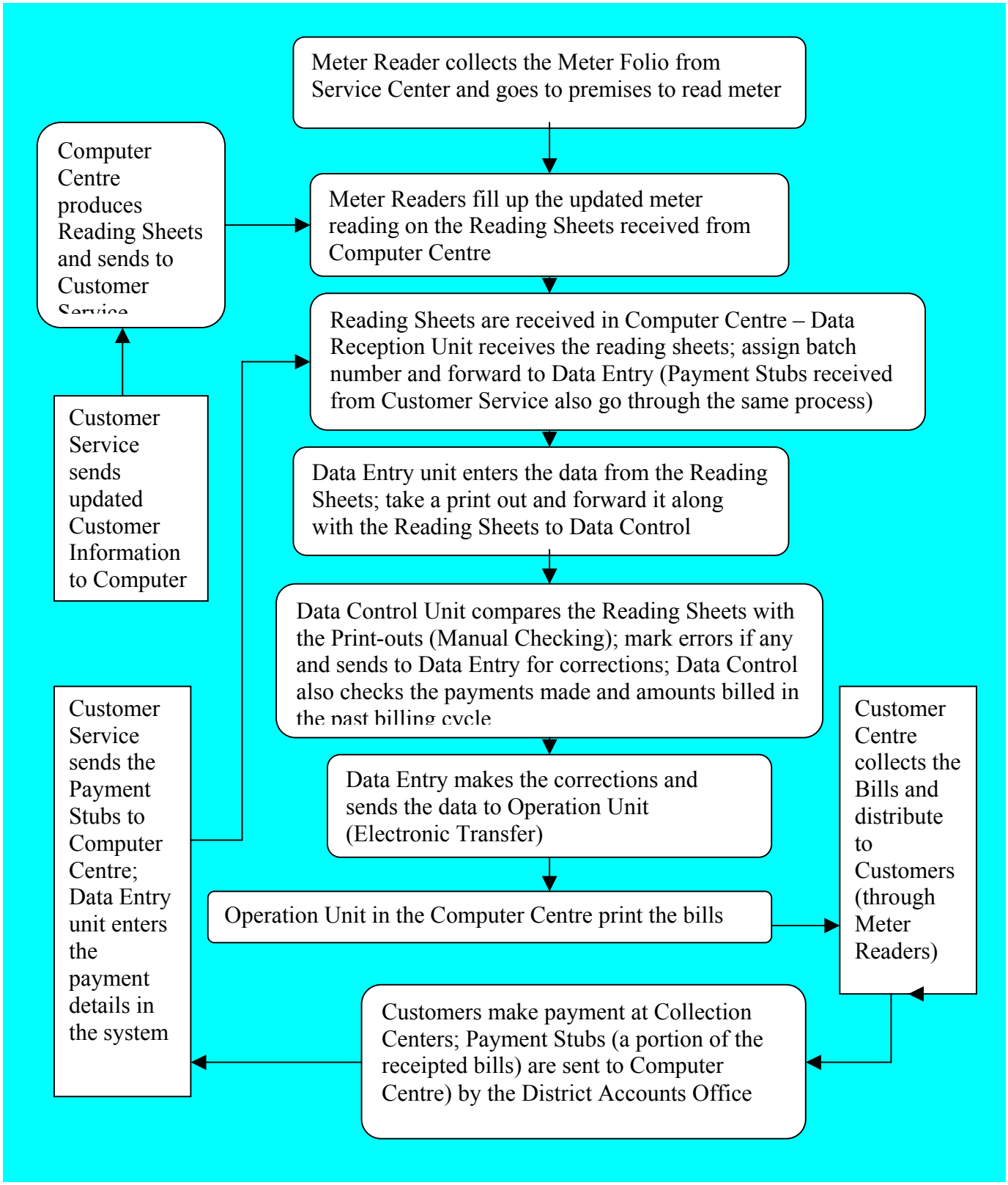
2.1.3 Cash Offices

Every Service Center has a Cash Office which is open from 8.00 AM to 5.00 PM, Monday to Saturday. One portion of the bill is retained with the Cashier, which is referred to as the Payment Stub. Customers after paying the amount to the Cashier need to go and show the paid bill to the Service Center, where the payment details are entered in a register called Customer Payment Register (CPR). Customers are made to sign on this register. At the close of each day, the Cashier verifies the total payment details entered in the CPR and tally with his records and sign on the CPR.

Payment Stubs from all cash centers are sent to District Accounts office; from there it goes to the Computer Center, where they enter the payment details in the "payment activity menu" of the billing software. The payment stubs are preserved in the Computer Center.

The Service Centers and District Computer Centers are under the Marketing Department and the Cashier is under the Finance Department. There are several Service Centers in each District. For example under Abuja District there are 12 Service Centers. In many districts, some of the Service Centers are located at distant places from the Computer Center (more than a day's journey by public transport).

The revenue cycle process is detailed in the diagram below:



2.2 BILL DISTRIBUTION

Bills are segregated according to geographical areas in the Service Centers. This is a tedious exercise, as bills are printed in the sequence of the Customer Account Number, which is a serial number assigned to new customers with out any prefix or suffix for the geographical area or unit. The Meter Reader goes to distribute the bills and take the reading for the next billing cycle.

In some of the districts the customer account number is being revised to make it area-wise and being regrouped to produce bills in the sequence of geographical order.

2.3 BILL CORRECTIONS AND CUSTOMER DATA MODIFICATION

Customer complaints on errors in bills are attended by the Service Center. The documents available here for verification is the Meter Folios and the CPR, where the previous payment details are entered. Once the error is sorted out, Service Center initiates a CAAD (Customer Account Adjustment Document) for which printed forms are available. CAAD goes to several higher officers for approval before it is sent to the Computer Center for correction. The corrections are carried out in the next bill only.

New customer data and customer data modification etc are communicated to the Computer Center through various printed forms called Customer Record Maintenance Documents (CRMD).

CAAD and CRMD formats are being revised by RCM Contractors in their respective circles. No uniform practice is being followed. As a result, in each area there will be different forms and different practices, which may further complicate the present problems.

2.4 BILLING SOFTWARE

The main software used for billing in NEPA is the AVR Utility Billing Software, which is written in Progress/4GL and run on UNIX. This system was implemented in late nineties. This has no cash management module. The system menus are:

1. Customer on Set up Maintenance – COSM
2. Meter Management Maintenance Document (MMMD)
3. Meter Reading List on Meter Activity Menu
4. Payment Listing on Payment Activity Menu
5. CRMD Reports Menu
6. CAAD Reports Menu

7. Billing Activity Menu
8. Miscellaneous Menu

The Miscellaneous Menu gives the options to produce several reports, but only following reports are generated regularly:

1. Current Billing Revenue Report
2. Outstanding Balance Control Summary

It is reported that in Lagos region and a few other places the SPECTRUM software package is used for billing.

2.5 COMPUTER SYSTEM

The consultants visited the computer system in Abuja District, which has about 112,000 Customers presently. Two separate servers running on UNIX are used – one for Non-MD customers and the other for MD Customers. (MD stands for Maximum Demand a nomenclature used in NEPA for customers with a connected load of 100KW and above which are mostly commercial and industrial category). There are 6 numbers data entry terminals, 2 numbers of Tally T 6218 printers and Backup devices, UPS etc. The total manpower strength is 20 persons including the Manager.

2.6 THE PROBLEM AREAS

The review of the existing billing and collection process has brought out the following problem areas:

1. Lack of Dependable Customer Database: The Customer Database available with NEPA is not dependable. The main reason for creation of such database is because by definition a customer is the individual occupant of a house/flat/shop. In most developing countries where unique national identities are not in existence, electric utilities do treat a premise (house/flat/shop) as the customer. The tenant may change but the owner of the premise is always the customer for the electricity utility. This system not only ensures reliable customer data, but also reduces workload of the field units. In most of the rented properties, tenant changes every two years on an average; and every change places additional workload on NEPA system, in addition to the unpaid bills of the tenant.

   Even in towns like Abuja, the numbering of houses/plots are not in sequence and difficult to locate a premise with the address. In rural areas,

this problem is more serious. This makes bill distribution difficult for some one outside the NEPA system.

2. No checks on the Meter Reader: The meter reader updates the meter folio and also enters the meter reading in the reading sheets, which are not verified at any level completely except some random checks in the Service Center by the Supervisor/Manager. The Meter Reader is the only person who actually captures the data from the meter and initiates the billing procedure by entering the meter reads on the reading sheets.

   The Reading Sheets printed by the Computer Center are in the customer account number sequence; whereas Meter Folios are in geographical area-wise sequence. As a result when a Meter Reader finishes one Meter Folio book, he has to jumble through several pages of the reading sheets to enter the meter data. There is no mechanism in the current system to check for any errors committed at this stage.

3. Manual Bills: Bills are issued manually from the Service Centers – hand written bills on the blank bill forms. In some cases when the Payment Stub reaches the Computer Center they have no record of such a customer!

4. No Scheduled date for Payment: Scheduled date for payment is not indicated in the bill. Normally on any utility bill, there is a last date for payment after which there will be a fine or late fee. On NEPA bill format there a field "Due Date", where the date of bill is being entered. There is no date for last date for payment. It is assumed that bills are due for payment immediately on presentation. But then a customer can always dispute that he never got the bill. No fines being levied for late payment.

5. Part payment being accepted: In an effort to maximize collections, NEPA accepts part payments from customers. For example a customer who got a bill for 10,000 Naira for January can pay 2000 Naira and the balance 8000 will be added to the February bill. Many times this updating of the balance does not happen by the time February bills are generated. So he will get a bill with out past dues for February, which if he pays fully, there are good chances that his January balance many not get added to the March bill. There are no checks in the system to point out these kinds of errors, since most such activities are done manually.

6. Long Billing Cycle: Typically the consumption of January is read during 10 to 20 of January (this will be actually for the period from December reading till January reading date) and entered in the Reading Sheets and send to the Computer Center by 25 of January. The Bills are generated in first week of February and are collected by the Service Centers by 10 February. The bills are distributed and readings for February are taken during the period 10 to 20 February. Average customer pays the January bill in first week of March (when they get their February salary at the beginning of March). Which means NEPA supplied electricity for the period from 10 December to 10 January and sends a bill to the Customer in February and collects money in March where as NEPA has already paid for the fuel and other cost and salaries for the months of December, January and February! Any measure to shorten this long billing and collection cycle will have profound impact on the finances (and the bottom line) of the company.

7. "Crazy Bills": As explained earlier, the entire process involves manual methods and systems that are error prone. In an ideal environment, if the January bill is not paid and the February bill is under generation in the computer center (which will contain the dues of January), the Cashier will not accept the payment of January bill from the customer. But in NEPA the cashier accepts payment for the January bill when February bill has already been generated. Not only that, the customer can still pay part payment of his January bill. Thereafter when he gets the February bill in hand with the dues of January, he goes to NEPA and cries foul and calls it a crazy bill! Similarly, the payment stubs sent from the District Account office to the Computer Center are entered in the payment activity menu of the billing software. These are checked at the Data Control along with the new meter reads when the printed meter data input sheets are checked with the Reading Sheets. It is not very easy to check and tally the meter data and also the payment data with respect to the payment stubs, which are arranged according to the date of receipt of payment. Any errors at these stages can generate crazy bills. Normally a person goes and complains to NEPA when the error in the bill is to his disadvantage. Thousands of crazy bills generated to the disadvantage of NEPA go with out any complaints and corrections.

8. Billing Software: The AVR software version being used in NEPA is not very user friendly. Since it is run on UNIX operating system, NEPA's field staff are not able to trouble shoot the system or make any modifications. Even for changes in tariff schedules, NEPA cannot

implement it in AVR with out the support from the Vendor. Due to contractual issues, AVR has stopped supporting NEPA.

9. Shortage of Cash Collection Centers: In many places, people need to take leave for going to NEPA office for paying the bills. At certain places people have to pay almost as much as the bill amounts on the travel cost.

10. No cash management functions with the billing software: Modern billing software is integrated with cash management functions and also seamlessly integrates with the banking systems to get a real time update on the collection status.

11. No facility to pay by cheque: NEPA does not accept cheque payments from customers. They accept only cash or bank drafts. Many customers would find it easy to pay by cheque and NEPA can partner with agencies across the country to collect payment by Cheque on NEPA's behalf.

12. Coordination/Communication between Service Centers and District Computer Centers: Any delays in the coordination between these two key players in the billing cycle can upset the whole process. The Computer Center delays the printing of Reading Sheets because they get the CRMD forms from the Service Center late. The representative from the Service Center, who went to collect the bills and the reading sheets, will stay back at the Computer Center for few days till the Reading Sheets are ready which will delay the distribution of bills and also the meter reading for next billing cycle. Or he simply returns with the bill and go at a later date for reading sheets that will delay the next billing cycle.

    In short the computer centers are just a data processing and printing centers, which does not add any value to the Revenue Cycle Management; rather it can only contribute to delays in bill generation.

SECTION 3 RECOMMENDATIONS

This section offers recommendations that NEPA can implement with minimum cost to improve the identified problem areas.

3.1 DEPENDABLE CUSTOMER DATABASE

NEPA may change their policy of issuing new connections to tenants. All existing connections in the name of tenants should be changed to the property owners name by a certain date or at the time of the next change of tenant. This may involve new legislation; but it is the ideal time to do such major policy changes as the entire Nigerian society is watching with keen interest the changes taking place in NEPA and they may be prepared to give NEPA a chance to improve. Under such atmosphere, there will be minimum resistance to major changes in policies.

The difficulty with incomplete or un-locatable address is a problem that can be solved in two or three stages. When a new connection is given, the distribution office prepares a Residential Service Record Card (Form NEPA: 241). This card contains a hand drawn map of the premise to which the connection is given with landmarks and transformer location. This is available in the customer record files at the service centers. Since referring to the customer record files every time will be difficult, this map along with the customer account number can be photocopied and filed in a separate folder which can be referred for bill distribution. At a later stage, these maps can be scanned/digitized and made available to the NEPA billing system software, which can print the map of the customer premise on the bill itself. In an advanced stage, the customer database can be integrated with GIS (Geographical Information Systems), which can print the GIS generated map on the bills.

3.2 CHECKS ON THE METER READER

As explained earlier, the meter reader carries a meter folio to the customer location; enter the reading in the folio. And the same meter reader enters the reading from the folio to the reading sheet. The errors committed by the meter reader are presently going unchecked. To minimize the chances of this error, the responsibility for transferring the data from meter folio to the reading sheets may be assigned to another person in the service center. More ideally, the meter reader should carry the reading sheet produced in the walking sequence and record the meter reading directly on the reading sheets, which can be entered in a computer in the Service Center and sent to the Computer Center as a soft copy.

3.3 AUTOMATED BILL GENERATION

The system of issuing manual bills should be strictly banned. This will add pressure on the Service Center and the Computer Center to update the customer database more frequently. Two billing practices cannot co-exist in one system.

3.4 PAYMENT SCHEDULE

The bill should indicate a **"last date for payment without fines"** after which payments may be accepted with fines only. The subsequent bills should be inclusive of the late payment charges on the previous bills. This procedure will make customers more responsible in collecting the bills and paying on time.

3.5 PART PAYMENT FACILITY

Normally part payment should not be accepted. But in exceptional circumstances a higher officer may be authorized to approve payment in installments for clearing past dues. But under any circumstances, the current bill amount should not be accepted in part.

3.6 REDUCING THE LONG BILLING CYCLE

Some suggestions for reducing the billing cycle are:

- Computerization of Service Centers and Cash Collection Centers. The cost of computerization is not very high and the returns on this investment will payback from the very first year itself. Once NEPA establishes a wide network of computerized cash collection centers across the country, NEPA can collect payments for other agencies such as land taxes, road taxes, phone bills, water bills etc for a fee.

- Out-sourcing services of external agencies for bill distribution and collection. Local schools, voluntary agencies, shops etc can be partnered for bill distribution and collection.

- Mobile Collection Centers may be introduced, which can go to residential areas on weekends and in commercial areas during weekdays for collection of bill payment.

- All NEPA collection centers (including Mobile Collection Centers) should be able to print a duplicate bill and issue to the Customer, who has not received the bills. This can be made possible by sending the bills of every service centers in soft copies (written on CDs).

- Drop boxes may be introduced in popular locations where customers can drop the bill with a cheque drawn in favor of NEPA mentioning the customer account number. The photocopy of the cheque can be kept by the customer as a proof of payment; till a receipt is generated after the cheque is cleared and distributed along with the next bill.

- Partner with local Post Offices for bill distribution and cash collection can be explored. This is done very successfully in many countries.

- The communication between the Service Centers and Computer Center needs to be made faster; and to the extent possible may be made through soft copies. The meter reading sheets generated in walking sequence at the computer center may be sent to the service center in soft copies and be printed in the service center. Similarly, the filled up reading sheets can be sent to computer center in soft copies. This can be done through email also at places wherever email facilities exist. The bills generated can be sent to respective service centers in soft copies and printed locally.

- The entire system of pre-printed stationary is avoidable. Bills can be printed on normal A-4 sheets with the map of customer locations. The procurement of pre-printed billing stationery and its distribution to all computer centers and from the computer center to the service centers involve huge expenditure and delays.

- Inform the customers through several mediums that the bills for a particular billing cycle have been issued and those not received must contact nearest NEPA office for collecting a duplicate bill. This information can be broadcast through radio, television, newspaper, posters near places of worship, bus stands, local market places etc. Indicate the last date for payment also.

3.7 BILLING SOFTWARE

The billing software used currently is outdated and not user friendly. Any efforts to upgrade it or modify will be a waste of time and money. It is recommended to go in for modern billing software that runs on windows and designed for client-server architecture. Once a new billing system is implemented properly and the required operational discipline is observed, crazy bills will eventually become a thing of the past.

Key features of an ideal billing system are detailed in the next section.

SECTION 4 FEATURES OF MODERN BILLING SOFTWARE

4.1 IMPROVEMENTS IN MODERN BILLING SYSTEMS

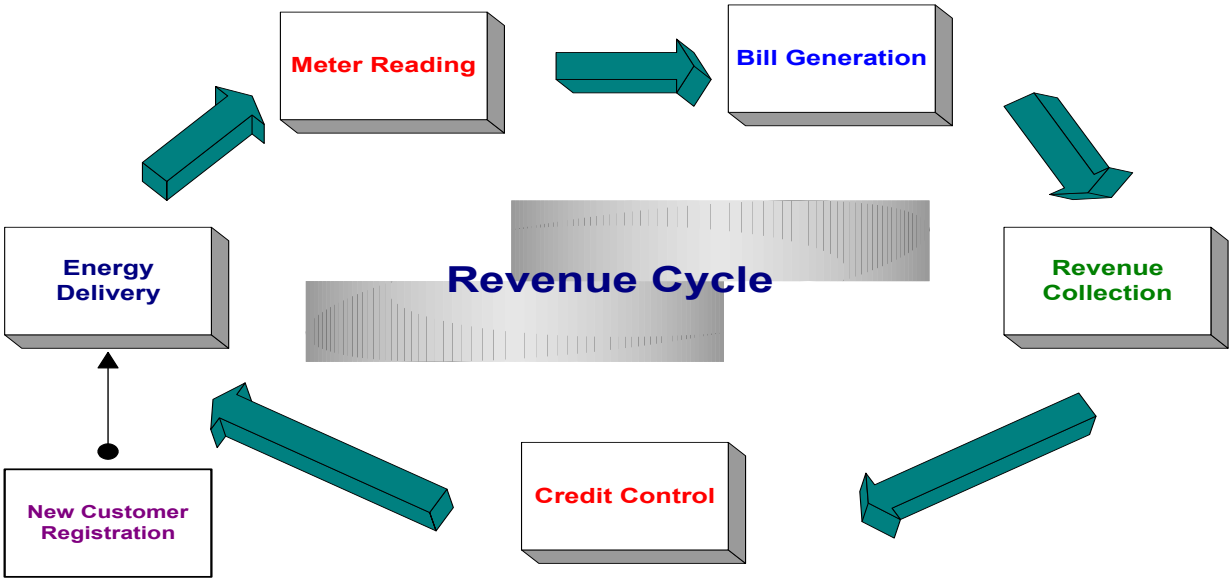
Modern utility billing solutions are not just billing packages; rather these are part of ERP modules that integrates with all functions of the organization. A comparison of modern billing systems vis-à-vis the legacy systems is given below:

Legacy Billing Systems	**Modern Revenue Management Systems**
Designed for single product/ service/ market	Multi-product/ multi-service/multi-market
Collects payments for use of a specific service	Customer-centric management
Simple one-to-one customer Relationship	Complex value chain revenue
Collects money: Billing = pricing and invoicing	Enhances revenue: Billing = Marketing
Stable service environment	Supports rapid introduction of new services
Passive post-event batch-orientated rating	Real-time authorization and pricing of transactions
Custom-built solution for specific business model	Multiple flexible business models

4.2 FUNCTIONS OF THE UTILITY BILLING SYSTEM

The functions of the modern utility billing system range from registering a new customer into the system to its bill generation and lastly to the calculation of the total system loss. Ideal systems are based on the concept of central processing with the data entry being done at the lower levels. This ensures a better control over the main bill generation and collection processes, with less involvement of the head office in the procurement of data. Central Processing also enables the utilities to exert a high level of security over the sensitive billing data. The data may be stored at the center with only query level access to the lower levels.

The diagram below illustrates the functionality of a typical billing module:



The Billing module should help the utility in registration of new customers, collection of the meter readings and payments and then finally in generation and printing of the bills. Most systems usually have the capability to perform energy audit at regular intervals and calculate the system loss at different levels like location, voltage, etc.

Master Setup: Proper functioning and total integrity of a billing system depend to a great extent on its master and parameter setup. This requires that this setup be secure from manipulation as well as simple to maintain. An ideal system solves this easily by facilitating the definition of the master information like the location, the bill cycle schedule, the banks and others in a very simple manner. At the same time the security feature maintains the consistency and integrity of the data by giving the authority to maintain this data, to a limited number of users.

Tariff Setup: The ever-changing rules of the regulatory commissions necessitate the dynamic feature of the bill calculation procedure for any utility. The flexible tariff structure built into the modern billing systems ensures that the users themselves can apply the changes in a simple and efficient manner. The system must have the capability to withstand frequent changes and ensure continuance and efficient performance of the system with minor disruptions.

Holiday Setup: The information about the holidays that fall in that state/region may be setup in the billing system and the Bill Cycle Schedule generation should be designed to consider all the holidays.

Customer Registration: A utility should generate the bills of only the registered customers. Thus whenever an application for a new connection comes in, the billing system processes the same, provide for inspection and registers the customer. At the time of registration all the details of the particular customer is also captured by the system and the customer is assigned its specific location, route, cluster and the walking sequence for meter reading. Ideal systems allows for Walking Sequence update and Re-sequencing whenever new customers are added with minimal restrictions.

Staggered Billing: With a huge customer base and a limited number of meter readers the meter reading data collection becomes a mammoth task for the utility thus making it extremely difficult for the utility to bill all the customers on a monthly basis. Modern billing systems put forth the concept of staggered billing to resolve this issue. This implies that the billing schedule for the total number of customers is staggered resulting in the billing cycle stretching across a full month. As the readings for different customers are collected on different dates the range of the Billing Cycle is extended making it possible to generate bill at any time interval for customer groups. The Meter Reading Schedule can be prepared according to Routes and Clusters thus facilitating the system in dividing the customers into different groups and billing certain group of customers at any point of time.

Meter Data Collection: A large customer database requires an efficient meter reading collection mechanism to enable timely completion of bills. To achieve this, the meter reading sheets are to be generated from the billing system in the order of walking sequence, which are then distributed to the meter readers. The readings can be entered in the reading sheets directly by the meter readers and then entered into the system using the double entry mechanism. These are then matched against each other to reduce the percentage of errors.

Amendment Processing: Each and every system needs a mechanism to incorporate changes and corrections/amendments in a streamlined and secure manner. The amendments may relate to correction of any data, which has a direct effect on the bill of a customer such as bill amount correction, the amendment of master data, disconnection, reconnection, meter replacement, meter repair etc. An ideal Amendment Processing system considers the effects of all the above amendments together with current meter reading and creates a

snapshot to present to the utility a virtual representation of the final scenario, as it will happen with respect to a particular customer. The utility can then take the appropriate action to proceed or stop. On proceeding the changes are reflected in the company's picture. This ensures the integrity of the system and enables the utility to address more than one customer complaint at the same time. This feature should consider the late movement of information from the field office to the computer system and thus should also be capable of addressing complaints, which have been lodged a few months back. The adjustments due to this late movement or any other correction is calculated automatically by the system and passed against the current bill. The feature to be included here are:

- Correction of meter reading related to past bills
- Multiple disconnection and re-connection in a month
- Meter exchange across meter type
- Amendments for earlier bill cycles
- Master amendment processing in bulk

Bill Correction: The system should provide for the following corrections pertaining to a bill:

- Opening and closing reading correction
- Meter condition change
- Meter type change
- Meter digit change
- OMF change
- Monthly likely consumption change
- Monthly likely consumption change in bulk
- Tariff change of a customer
- Sanctioned load & connected load change
- Transformer information change

Bill Processing: The bill generation process is the most important part of any Billing system. The most critical feature of this process is the flexible tariff structure. With minor changes in the parameters the process should be able to take care of any tariff changes (rate change or logic change). This process should take care of pro-ration of consumption across bill cycles, recalculation of old bills and generation of automatic adjustment. The system should have the features of charging penal consumption and automated surcharge waiver in case of credit adjustments for old bills. The concept of small coin processing may be incorporated to ensure that the bill amount is always rounded up and a small coin adjustment passed against the next bill for the decimal figures thus reducing unnecessary complications in daily monetary matters.

Payment Collection and Offsetting: The collection system of any Billing System, being directly linked to money matters, needs to be extremely secure to minimize the chances of corruption. Ideal systems facilitates this by incorporating the option of bar-coded bills and interface with POS machines thereby increasing the reliability of payment verification and also by allowing for double operator entry of the payment data. The payment collected through banks or from different offline centers should be entered by two operators and matched against each other. Any mismatches found are then reported and the field office can take the appropriate action. This reduces the percentage of errors by a high amount thereby increasing the integrity and reliability of the system. The payment information to be entered in batches and in case of any inconsistency the data should not flow into the core tables. However to ensure continuity of the bills there could be the option of forceful posting of batches whereby the payments are absorbed in to the system.

The offsetting rule for payment differs from one utility to the other ranging from FIFO (first-in-first-out) to LIFO (last-in-last-out) basis on one hand and from offsetting priority within a bill to offsetting priority across bills on the other. Ideal billing systems are parameterized for adaptability of all of the above offsetting rules. The system should also consider the late flow of collection information and passes the appropriate adjustment against the surcharge already charged against the customer, thus enabling the system to meet customer satisfaction.

Payment Cancellation feature may be incorporated to help the utility to correct any error in payments including bounced cheques and incorrect entries.

Types of Billing: Apart from the regular customers a utility can have special customers such as:

- Single Point Metering – One meter and multiple customers and all sharing the load on an equal basis.
- Customers with check point meter – One audit meter at the point of supply and multiple customers being supplied through that audit meter point. In this case a loss consumption part is calculated and apportioned against the customers to arrive at the total consumption figure for each customer.
- Customers with Temporary connections
- Customers with Seasonal connections

The billing system should facilitate accommodating the above categories of customers and generate their bills.

Complex Billing: Utilities may include complex billing and pricing programs within an overall energy data management strategy that includes analysis of customer consumption profiles, the relationship of those profiles to supply the grid flow, and the development of techniques to improve system operation and increase efficiency. Complex billing starts with consumption metered separately during prescribed time intervals - every quarter or half hour, for instance. To produce a bill, meter data management and billing software prices the consumption according to the terms of a contract between the utility and the customer.

The billing system should have the features to processes the time-series data according to the terms of a contract between the utility and the customer; for example, mapping it to prescribed Time-Of-Use periods; produces customer bills that may include a significant level of detail. These help commercial and industrial customers better manage their energy consumption and reduce total energy costs.

Reduction in Billing Cycle: Reducing the billing cycle is the single most issue that can improve the utility finances. The modern billing systems have robust back-end computer systems (BCS) that can capture and convert the meter data from a variety of sources: AMRs, Hand-held terminals, Optical Readers etc that can reduces the meter data collection time. Bar – coded bills can reduces the verification of payments, thus saving time in validation of data. The above together with the concept of staggered billing can substantially improve the total time span of one complete billing cycle.

Energy Audit: In modern utilities, audit of energy is carried out at different levels at regular intervals of time. The billing system should be equipped to capture the information about the link between the different entities, namely transformer, feeder, audit meters and also the customers and make the loss calculation a simple task for the utility. This feature will enable the utility to monitor its losses and its revenue and will present a complete picture to the management on the trends in its energy flow.

Maintenance History: The billing system should be capable of storing historical information relating to certain master data like the customer's address, his bank, his monthly likely consumption, the load sanctioned to him etc. At the same time the full history of the transactional data, for example the invoice and payment records pertaining to a customer should be maintained. Thus at any point of time any past record of the customer is available to the utility. Some of the heads for which the information may be stored is as follows:

Customer History

- Name
- Address
- Bank
- Tariff
- SL/CL
- Monthly Likely Consumption
- Average Consumption

Meter History

- Meter Digit
- OMF
- Repair
- Service
- Exchange
- Invoice Details
- Meter Readings
- Consumption
- Arrears

Other Features: Apart from the above general processes the system should offer features such as:

- relocation of a customer's premises without termination of the customers account
- Installment processing
- Extension of the bill due date at a mass level
- Handling of dispute bills
- Miscellaneous bills
- Generation of Month of Day reports
- Closing of customer account and write-off.
- Waiving of surcharge at a mass level.

Customer Service Features: The system should facilitate customer query related to billing, arrears, application and customer information. It may also provide a customer complaint section to enable the utility to keep track of the complaints, attend to them and ensure final resolution of the same.

Security Features: Employing a large number of people in its daily activities coupled with the sensitive nature of the billing process makes it necessary for the utility to exert some sort of checks and control over its employees. The

system should ensure this by maintaining an audit trail of the users using the system. The dynamic allocation of privileges to roles and roles to users, and a login username and password provided to each user to be covered in the security scenario.
The system should offer a locking mechanism whereby it is possible to exert control on the process dependency between different processes to restrict ad-hoc firing of the different processes by the users and ensure that the processes are run in a proper sequence thereby eliminating the conflicts within different processes.

Reporting Features: The billing system should facilitate the generation of consolidated reports at various levels such as:

- List of New Applications
- Amendment Status Listing
- Consumption Exception Report
- List of Customers Category-wise
- Consumption Analysis Reports
- Bill Register
- Bill Statistics Report
- List of Customers with Outstanding Balance
- Collection Status Report
- Age-wise Arrears Report
- Customer Ledger
- Month of Day Reports
- Summary of Key Factors
- Energy Audit Report
- System Loss Monitoring Report

The system should offer the facilities to create any type of MIS from its database on any format.

Appendix A: Examples of Modern Billing Software Packages

Description of EN'RGISE Software with Integrated Customer Billing

EN'RGISE (ENterprise Related Generalised Information SystEm) from Tata Consultancy Services helps the utility manage business transactions online. It aims to identify and cater to the common and generalised requirements of this sector. It can be adopted by any organisation with minimal reorientation of existing infrastructure. EN'RGISE is designed to cater to multiple business requirements in the Electric utilities sector. It offers value-added services to tackle the diverse functional domains relevant to this sector.

EN'RGISE caters to inter-divisional and intra-divisional requirements in the following fields: materials management, operations and maintenance, human resource management, energy billing, energy accounting, fuel management, and finance and accounts. There are separate modules in the system for each of these applications as listed below:

1. Materials management system
2. Operations and maintenance management
3. Human resources management
4. Finance and accounts
5. Payroll accounting
6. Fuel management
7. Energy billing
8. Energy accounting
9. System administration

The system is modular that each module can be implemented at different points of time and will seamlessly integrate with other modules. The system has Open Data Base Connectivity (ODBC) approach that will allow the application to be mapped on to any existing database.

It has a highly user friendly Graphical user interface and offers complete Modular independence — the entire package is divided into 9 independent modules that are loosely coupled and are able to work cohesively in any logical sequence.

The modular approach and the rapid-implementation methodology enable organisations to use the product in a cost-effective manner.

Systems environment

EN'RGISE is designed to run on client server architecture. The database may be centralised or distributed. The client server architecture for EN'RGISE has the following configuration:

- Front end: Windows 95 / 98, Windows NT 3.51 or higher.
- Back end: ODBC-compliant database (SQL Server, Oracle, Ingres etc) running on Windows NT, Unix or other operating system.

1. Energy Billing Module: The broad functions of energy billing are:

A) Application processing

- Receiving applications.
- Approving applications.
- Site inspection and estimation.
- Generating work orders.
- Updating the application data store with post-installation information.

B) Customer information.

- Customer information
- Meter information.

C) HT and LT billing

- Defining billing parameters.
- Processing meter readings.
- Generating bills.

D) Recovery of dues

E) Generation of MIS reports

- Status-wise reports of applications.
- Application register.
- Summary of new installations.
- Reports on unavailable meter readings.
- Details of payments, consumption and demand.

F) Collection and remittance

- Age-wise analyses and trends in arrears reports.
- Demand collection balance report.

2. Energy Accounting Module:

The energy accounting module aims not only to closely monitor the energy flow within and beyond the organisation, but also to help identify areas where system efficiencies can be improved. The module provides reports on the energy losses at each level of the transmission and distribution network, and within specific geographical regions. It also helps identify long- and short-term strategic management trends.

The broad functions of energy accounting are:

A) Generating station efficiencies

B) Transmission and distribution efficiencies

- Defining component-level normative efficiencies.
- Measuring actual efficiencies reported under varying operating conditions.
- Developing a reference database to be used for studying performance curves.
- Providing early-warning signals to planning activities.

C) Monitoring conformance with metering requirements

D) Energy flow diagram

E) Energy balancing

F) Performance degradation analysis

G) Benchmarking

- Maintenance of statutory and industry standards.
- Analysing impact of the variance between actual and benchmark.
- Developing a reference database to validate benchmarks.

H) Fuel procurement and handling efficiency

I) Estimation of non-metered consumption

- Algorithm for estimating category-wise, non-metered consumption.
- Validating estimated un-metered consumption.

J) Trend analysis and forecasting

- Defining the trend-analysis model and statistical guidelines.

- Identifying trend elements, seasonal elements and random elements.
- Correlation and regression analysis between pre-defined parameters such as time, HT-LT sales ratio, system units per circuit km of network, etc.

K) Auxiliary and captive consumption

L) MIS reports

- Fuel-consumption reports.
- Energy-consumption reports.
- Equipment-performance reports.
- Metering arrangements adequacy reports.
- Non-metered energy consumption.
- Trend analysis in various energy accounting sub-domains.

3. Fuel Management Module:

The fuel-management module meets a very critical requirement in the utilities sector: monitoring fuel-consumption bills. To achieve this, the module maintains the key sections of the fuel-supply agreement, monitors fuel-unloading activities, processes bills and generates MIS reports.

4. Finance and Accounts Module:

The finance and accounts module is one of En'rgise's major components. The general ledger accounting sub-module is designed to handle multi-site transactions, and is able to map on to organisational business rules. The payroll sub-module tracks employee development and processes payrolls. It also issues customised and detailed reports on employees and generates accounting reports. The accounts payable sub-module processes bills or invoices and other procedures (such as payments to vendors). The inventory accounting module handles the accounting work necessary for the material transactions that are carried out therein.

5. Human Resources Management System Module:

The human resource management system (HRMS) module of Energise aims to manage employee information by minimising paperwork in the personnel department. The objective of the HRMS module is to manage the recruitment of a workforce and track developments related to the employees of the organisation. These may be assessed in the form of promotions, transfers, deputation, leave, etc. The module also provides reports on period-to-period details of the employee. HRMS aids in

improving manpower planning and in the effective utilisation of manpower across the organisation.

6. Materials Management Module:

The materials management system (MMS), an integral part of En'rgise, can take care of the entire range of requirements of an organisation's materials management department. It is designed to cater to organisations that use central databases, as well as to those using distributed or decentralised databases. The objectives of the MMS can be stated as:

- Automation of materials management activities.
- Reduction in inventory of materials and improved materials planning.
- Effective purchases through vendor evaluation.
- Standardisation of work procedures.
- Better scrap management.
- Generation of MIS reports for better decision-making and control.

7. Operation and Maintenance Module:

The operations and maintenance (O&M) module of En'rgise helps to improve the reliability and maintenance of plant and equipment, maximise capacity utilisation, increase operating efficiency, and reduce operating and maintenance costs.

The objectives of the O&M system can be broadly stated as:

- To reduce equipment operating and maintenance costs through effective utilisation of capacity and resources.
- To increase the availability and reliability of plant and equipment with effective maintenance planning.
- To improve spares planning and reduce spares inventories.
- To standardise work procedures.
- To ensure the safety of maintenance personnel.
- To provide a mechanism for making estimates and controlling maintenance expenses.
- To generate MIS reports for better decision-making and control.

8. Pay Roll Accounting Module:

The payroll accounting module manages the payroll accounting functions of the organisation to ensure compliance with statutory requirements such as income tax, provident fund, etc. It has been designed to take care of

promotions, transfers, deputation, leave, etc, and it provides reports on the details of employees.

9. System Administration:

The system administration module ensures smooth operation and maintenance of individual modules, and the integration of different modules. It takes care of the initial set-up, configuration, security settings, and other database administration activities.

The functions of SA can be broadly these:

- User maintenance.
- Backup and recovery.
- Archival.
- Database administration.
- Menu management.