Unit 9

Overview of Distribution Business and Information Technology

Learning Objectives

After studying this unit, you should be able to:

- **explain the need for IT in the power distribution sector;**
- **describe key areas of IT interventions in the power distribution sector;**
- **outline the infrastructure needed to IT-enable the distribution business; and**
- **discuss the issues pertaining to change management for developing IT-enabled organisations.**

9.1 INTRODUCTION

Distribution of electricity is one of the largest and most extensive businesses that require attention to detail on a large scale. In the course BEE-001, you have studied about the transformation of the Indian power distribution sector. The power sector is being reformed in order to meet the increasing demand fuelled by high economic growth. The SEBs are being unbundled to introduce efficiency and modern management practices in the component sections, viz. Generation, Transmission and Distribution. It is expected that this process will lead to greater accountability. More importantly, the current thrust of reforms focuses extensively on curtailing AT&C losses, which are of an extremely high magnitude.

Studies conducted in several states and by the Central Government as well as the experiences in the advanced countries have brought to fore the significant role of Information Technology in improving the efficiency and accountability in the distribution sector. In this unit, we first present an overview of the electricity distribution business and then focus on the need for IT based interventions in the distribution business. You will study about the potential IT applications in the distribution business as well as the change management required in your organisation for the effective use of IT. In the next unit, we acquaint you with the specific applications of IT in distribution network management.

9.2 DISTRIBUTION BUSINESS AND THE NEED FOR INFORMATION TECHNOLOGY

You are well aware of the challenges facing the power distribution sector in India and the reforms that have been initiated in the sector with the following objectives:

- Reduction in energy and revenue loss (AT&C Losses);
- Improved efficiency;
- Increased quality and reliability of supply;
- Increased consumer satisfaction; and
- Increased transparency in all areas of business operation.

The reforms in the power distribution sector have also underscored the need for **treating electricity distribution as a profit making business enterprise**. In order to appreciate the need for IT in the power distribution sector, you need to understand the changes brought about in the sector itself due to the reforms. Fig. 9.1 compares the traditional electricity business environment with the emerging scenario. Traditionally all the interactions and transformations of data and communication took place within the single vertically integrated monolithic block called the State Electricity Board (SEB). However, the post-reforms environment and organisational structure have

taken a different shape with multiple participants interacting with each other to recreate the integrated electric utility.

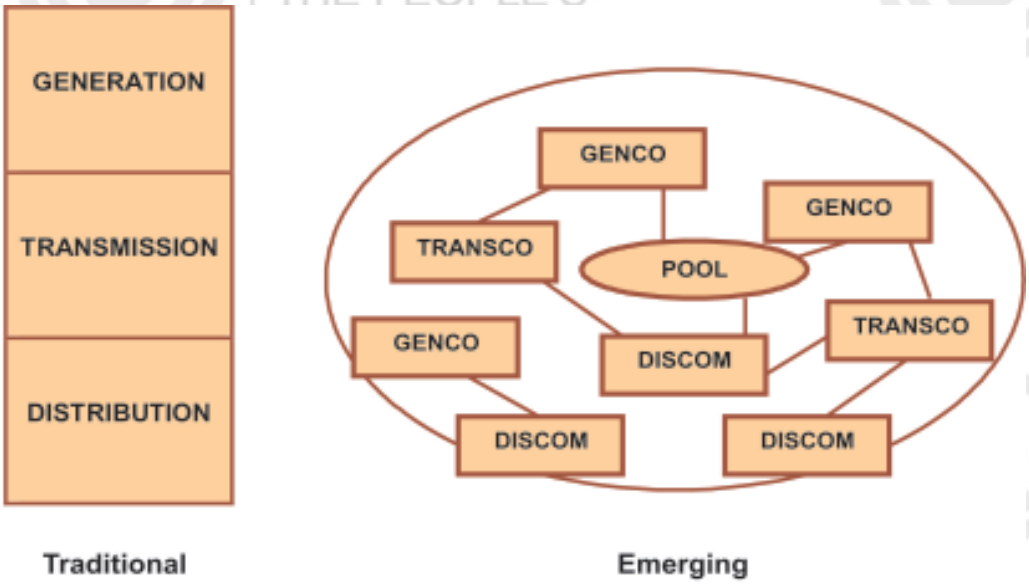

Fig.9.1: Changing Environment of the Electricity Business

The SEBs have been unbundled and new generation, transmission and distribution companies have been created. As a consequence, information interchange needs have emerged necessitating the use of Information Technology. Initially, the utilities used stand-alone IT systems and the integration of the different business processes such as billing, finance, operations, etc. was non-existent. However, the changes brought about by the distribution reforms in the electricity business underscore the need for integrated IT interventions. You may like to understand this aspect in some detail.

It is also important for you to understand the nature of electricity as a business commodity. You may like to know about the physical and economic attributes of electricity that give it its unique and unusual character. These are given in Box 9.1.

Box 9.1: Attributes of Electricity as a Serviceable Commodity

- **Electricity cannot be stored economically and demand must be cleared with "just-in- time" production from the generating capacity available to the network at (almost) exactly the same time that the electricity is consumed. Thus, supply and demand have to be cleared continuously at every location on the network.**
- **The short-run demand elasticity for electricity is very low and supply gets very inelastic at high demand levels as capacity constraints are approached.**
- **Loop flow, resulting from the physics of power flow in AC networks, introduces additional complex interactions between generators at different points on the network.**

NOTE

The **elasticity of demand** measures how much consumers respond in their buying decisions to a change in price. If price increases by 10% and consumers respond by decreasing purchases by 20%, it means that the consumers respond a great deal to a change in price. If, on the other hand, a 10% change in price causes only a 5% change in sales, economists would say that the demand is inelastic.

The demand is inelastic whenever the ratio of change in sales to price increase is less than one. Products that have few good substitutes generally have a lower elasticity of demand or are said to be **price inelastic** than products with many substitutes.

Let us now study the reasons why IT is needed in the electricity distribution sector.

9.2.1 Need for IT Based Interventions

You may well be aware that the use of Information Technology has transformed the way business is conducted in several sectors of the economy such as banks, railways, air transport, and other service sectors. You must have yourself taken advantage of this technology while shopping, booking tickets, touring places, making phone calls or accessing information on the web. The same level of IT use is expected in the Electricity Business but the problem is that large numbers of villages have no access to electricity. The end-users of electricity like households, farmers, commercial establishments, industries are confronted with frequent power cuts, both scheduled and unscheduled.

Power cuts, erratic voltage and low or high supply frequency have added to the 'power woes' of the consumer. These problems emanate due to inadequate power generation capacity, lack of optimum utilization of the existing generation capacity, inadequate inter-regional transmission links, inadequate and ageing sub-transmission and distribution network leading to power cuts and local failures/faults, large scale theft and skewed tariff structure, slow pace of rural electrification, and inefficient use of electricity by the end consumer and lack of grid discipline.

We now briefly explain the need for IT interventions in the power distribution sector, which arises due to many reasons (Box 9.2).

Box 9.2: Why is IT needed in the Power Distribution Sector?

IT is needed in the Power Distribution Sector for

- **supporting reduction of AT&C losses and increase in revenue generation;**
- **information exchange for optimal utilisation of resources;**
- **improving efficiency of operations;**
- **better management of the utilities;**
- **removing theft, illegal connections such as hooking and effective measures to convert them to regular connection followed up by systematic billing and collection of energy charges; and**
- **hundred per cent metering and effective Management Information System (MIS) for monitoring at feeder level, backed up by detailed energy audit to bring accountability into the system at all levels.**

High theft and poor collection are obvious reasons for an IT solution to India's power distribution. The nature of AT&C losses has been covered at various places in other courses. You have read that the major components of

the loss are: Lack of metering, poor collection, lack of complete billing, outages, transformer losses, poor HT/LT ratio and power theft.

You know that electricity distribution is spread in a large geographical area within the control of any utility. Electricity is carried through overhead wires, which are mostly bare. In such a situation, quite often, there is a temptation in human beings to enjoy the benefits of electricity without paying for it, particularly, if there is no social stigma attached to it and it is easily possible. There are long spans of low-hanging fruit (no pun intended) in the form of Low Voltage (LV) distribution (or even Medium Voltage – MV – distribution). In the rural areas, most agricultural pump sets are un-metered, with flat-rate pricing based on nameplate capacity. Utilities have no physical means of knowing the losses in the system.

Most of the transmission systems within the utilities are reasonably secure, in that commercial losses are relatively low. Many utilities have invested in newer meters for increased accuracy, and the moves towards unbundling have mandated greater accounting accuracy as now power changes hands from the TransCo to the DisCom. In addition, it is vastly more difficult for consumers to steal power at higher voltages. So, while **utilities often know the power entering a substation, from that point onwards they have three unknowns to account for: technical (distribution) losses, theft, and agricultural consumption**. Thus, we can see that there is significant leeway for errors, both purposeful and best-effort.

These factors together with the rapid expansion of the distribution network in the last two decades have resulted in increased revenue loss in the business of power distribution. In such a situation, **the introduction of IT in the business can lead to better information flow in real time about the extent of losses at various points and help in curbing them**. The experience from the developed countries has shown that IT can be used effectively to check and control the losses due to these reasons at least to some extent. Even a small reduction, say, of **1-2% could mean effective addition of 800 MW to 1600 MW** in capacity. This means that the savings could be of the order of Rs. 300 Crore to Rs. 5000 Crore!

The **metering system** is the most important process for a utility, because it deals with a large number of consumers and millions of units of electrical energy. The process has direct impact on the financial health of the utility as well as on its operational performance. Thus it is very important to have in place a process supported by technology which can monitor and record all the electricity transactions, with timely delivery of bills to the consumers and timely collection of payment. The meter type and meter reading process impacts the cash flow cycle. The reduction in meter reading process cycle can reduce considerable time from the meter reading to bill submission and payment collection.

At present, feeder meters installed for measuring the inflow and outflow of energy at 33/11 kV substations across various utilities are mostly static type having data downloading facility. Some of them are static meters without

downloading facility and some are still of the electromechanical type. Meter data of feeder meters is recorded manually in log books in almost all substations of utilities across the country. In spite of installing feeder meters with data downloading facility, manual recording is continuing in most of the places. Some utilities are downloading meter data with Meter Reading Instruments (MRI) but the downloaded data are not utilised. A few utilities had implemented the Automatic Meter Reading (AMR) system only for feeder meters but without acquiring and using the comprehensive meter database for further monitoring, analysis, energy accounting, auditing and system planning and augmenting purposes. Also, the meters installed are of different make and due to lack of inter-operability of meters, the data of different make of meters are not compatible on a common platform.

Thus, **there is an urgent need for IT interventions in this respect** for the following reasons:

For the purpose of reducing AT&C losses, it is important to carry out proper energy accounting and auditing without human intervention to identify loss pockets for initiation of corrective actions by the utility. Instant and reliable information on power supply reliability and quality standards for the utility's own monitoring as well as to meet the requirement of Regulators would be available. Moreover realistic load forecasting and system planning on short, medium and long term basis would also be possible. And it would increase transparency in system operation.

Secondly, the success of any business depends on the **smooth interchange of information across the organisation**, which helps in taking prompt and timely decisions for optimal utilization of the resources. With the rapid expansion of the distribution network and the increased consumer base, it has become unwieldy to manage and run the electricity business on traditional lines wherein by the time the information is made available, it is outdated and hence redundant.

In the present scenario, it becomes very difficult to get any information in the business processes of the utility. For example, it becomes difficult to get the data for energy, the health of the system, finance (collections) and assets. MIS collected and compiled manually are generally voluminous, and mostly not used by the management. Moreover, there are clerical and wilful mistakes in critical reports. You would agree that for any business to be successful, the accountability and responsibility at all levels with **accurate reporting** is absolutely essential. Improved availability of different modes of cheaper communication is an added advantage for making MIS available on real time basis to all stakeholders.

Thirdly, efficiency improvement can be brought about by appropriate energy accounting wherein the DTR level monitoring of the energy account leads to localization of the problem and thus fixing of accountability and responsibility.

Fig. 9.2 presents, in a nutshell, the scope of IT involvement in the Distribution Business.

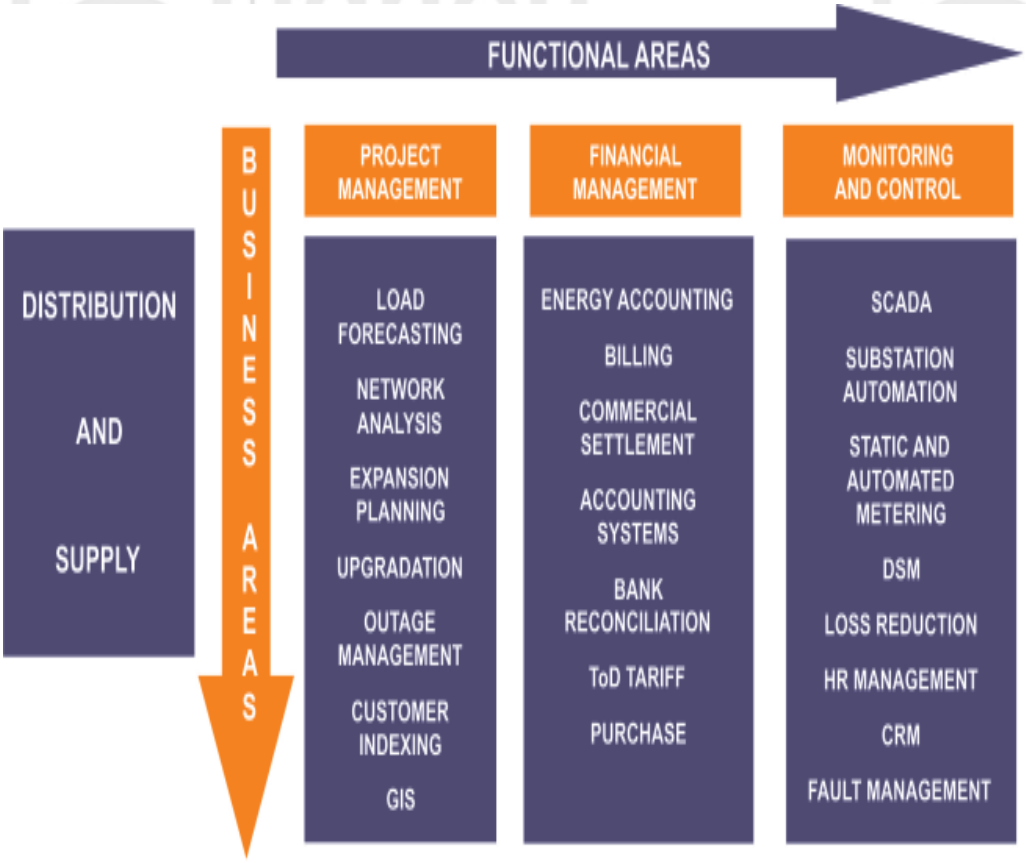

Fig. 9.2: Scope of IT in the Power Distribution Business

REMEMBER: IT enablement is now a mandatory component for utilities which seek funding from the Government and IT enablement of distribution business is now a prime objective.

India as a whole has done exceptionally well in bringing about technological advances in IT systems and using IT in various sectors. We have world class talent available but the penetration of the same is quite low as on date in the distribution business of our utilities. You may know that internationally, there has been heavy dependence on IT-enabled systems in this sector, e.g., in South Korea, South Africa, Europe, USA, Latin America, etc.

We now present a few case studies that bring out the extent to which IT is being used by distribution utilities today.

IT Use by Bescom

Bescom, one of the four distribution companies formed out of Karnataka Power Transmission Corporation Limited (KPTCL) in 2002, is responsible for power distribution in six districts of Karnataka. There is a high level of IT use in the company. Its website – http:// www.bescom.org – offers many services and there is also an e-CRM system. The company has call centres functioning under its **central complaint division** which receives billing and power supply complaints through the IVRS, landline telephones, SMS and

e-mail. Billing is computerised using the BNC software. Spot billing is also implemented by the company in all the 98 subdivisions. A survey has revealed a rise in customer satisfaction from 47 per cent in 2000 to 92 per cent in 2005.

Bescom is also using IT to support its business processes. It has implemented the Management Information System (MIS), a cash management system, a works management system and a material management system. All financial transactions are computerised. The Geographical Information System (GIS) has been introduced and the company is planning to subscribe to an ERP system (see Unit 10). All rural divisions are connected through a wide area network (WAN).

To improve its operational and commercial performance, Bescom has implemented many systems: feeder network analysis, transformer management, transformer-wise energy audit, automated meter reading and meter management. It prepared a project for online monitoring of power distribution in Bangalore. The entire supply network – including substations, feeders, distribution transformers and main power lines – will be linked to a computer network for online monitoring. The functioning of the system will be monitored from a control system. The IT team is very small – only two people – and most daily services such as network monitoring and maintenance of the website have been outsourced. For these IT initiatives, the company spent about Rs.100 million in 2005-06.

West Bengal State Electricity Board (WBSEB) and the Use of IT

IT initiatives in WBSEB include the setting up of a zonal data warehouse and a call centre acting as a single-window service for prospective and existing consumers, remote metering for bulk consumers, and GIS mapping of electrical installations. In order to improve its billing and collection efficiency, the Board has introduced 100 percent computerised billing. Thirty percent of the cash collection is done through online transactions. An application monitoring system has also been established.

IT is being used to support and integrate WBSEB's business processes. It has established an MIS, a material management inventory system (MMIS) for inventory, a personnel information system (PIS), and employee resource centres for effective administration. It has also introduced GIS and satellite communication (SATCOM).

The organisational setup for IT consists of three divisions: the Entrepreneurship Development Programme (EDP) cell, the EMC and SATCOM. The EDP cell controls most of the IT activities in WBSEB and is headed by a deputy chief engineer who is helped by senior and deputy engineers. The EMC division takes care of activities such as metering, GIS project and spot billing. The team consists of an additional chief engineer, a superintendent and deputy engineers. The SATCOM team, which is implementing IT initiatives such as V-SAT-Wan, MIS and MMIS, consists of a chief engineer, a superintendent, a deputy engineer and assistant engineers.

In 2005-06, the Board spent Rs.139.8 million on IT, mainly on two projects: the electricity supply station modernisation project (Rs.75 million) and the GIS project (Rs.64.8 million).

Uttaranchal Power Corporation Limited and IT Use

Uttaranchal Power Corporation Limited (UPCL) manages and operates the transmission and distribution of power in 13 districts of Uttaranchal. It is making concerted efforts for more pervasive IT usage in the corporation. All its units are connected to the head office at Dehradun through a leased line network, which runs enterprise database applications and intranet workflow applications.

UPCL is using IT to improve operational performance through computerising the consumer commercial database using GIS technology in the Dehradun and Roorkee distribution circles which are strategic from the revenue perspective. With the help of the GIS database, it has mapped every electrical consumer with the corresponding network element, right from the substation, feeder and distribution transformer up to the LT pole in these two circles. UPCL has also developed a software system for load-flow studies whereby it is in a position to identify feeders and distribution transformers having huge technical losses. IT usage also helps the management to make informed decisions on network reconfiguration and load management. In order to improve customer satisfaction, it is operating computerised billing centres where customers can lodge complaints or raise queries. It has also started an IVRS-based call centre in Dehradun, integrated with the consumer and substation database on a pilot basis. There is also a website – http://www.upcl.org – for consumers to download application forms for a new connection, load enhancement or disconnection. At present, there is no facility for consumers to access their billing data or make payments via the internet.

The utility has a separate annual IT budget of the order of Rs. 1 crore. A separate amount is specified for some projects such as substation automation and remote metering. The IT department is headed by a deputy general manager. The team is relatively small so it has to draw its resources from functional domain users and develop multi-skilled cross-functional teams.

The case studies described so far would have given you some idea of the scope of IT usage by power distribution utilities. In the next section, we examine the potential role of IT in detail for improving the power distribution sector in India. But before studying further, you may like to attempt an SAQ.

SAQ 1: Need for IT in power distribution

Outline the areas in your utility, which would benefit from the use of IT.

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9.3 POTENTIAL OF IT IN THE POWER DISTRIBUTION BUSINESS

Before we discuss IT based interventions in the power sector we would like you to understand what IT is.

What is Information Technology?

Information Technology is a term encompassing all forms of technology used to ***Generate, Collect, Transmit, Process, Analyse, Store and Present*** **information** to help users in taking well informed decisions.

IT includes signal processing and data acquisition, collection, onward transmission to other locations, storing in data servers, processing of data by applying user friendly applications stored in application servers and finally presenting the result of data processing to the personnel in the form of graphs, charts, tables, etc.

Thus, IT can be used for the betterment of the utility and provide competitive edge over the other market forces.

9.3.1 Key Areas of IT Interventions in the Distribution Business

For successful penetration of IT backbone in distribution network, the key areas of IT interventions in distribution business are listed in Box 9.3.

Box 9.3: Key Areas of IT Interventions in the Distribution Business

- **Consumer Indexing**
- **Metering, Billing and Collection**
- **Energy Audit and Accounting**
- **Material and Asset Management**
- **Network Management**
- **Financial Management**
- **Sub-division Computerisation**
- **Substation Automation**
- **Project Management**
- **Customer Relationship Management**

NOTE

The discussion in Sec.9.3.1 has been adapted from the article 'Need of IT in Distribution' by Shri Shikhar Agarwal, IEEMA journal, March, 2005, p-64.

We now briefly explain the potential role of IT in some of these areas.

- **Consumer Indexing:** Utilities need to maintain the database of their consumers and keep a track of addition of new consumers, increase in consumer loads or disconnection of consumers. Though tagging of consumers with concerned feeder had started in Indian distribution utilities with the start of Energy Audit, yet consumer indexing in detailed fashion using GPS technology has started only in the recent past. A large number of cities and towns have been taken up for consumer indexing.

  Some utilities have preferred GPS based indexing system, while many others have adopted a simpler system. One of the direct benefits of the indexing has been capturing large number of unauthorised users of electricity. It has also resulted in better planning like shifting of transformers to the load centres, re-conductoring leading to better tail-end voltages and better fault management system. The real benefit of the consumer indexing would, however, be reaped when it is integrated with the fault management system in a comprehensive way. Many utilities have gone in for consumer indexing as a one time exercise and have not been able to update the database thereafter. This has led to the situation where benefit of the indexing has not been utilised in full.

  The need of the hour, therefore, is to have consumer indexing done in such a way that it gets integrated on a real time basis with the business operations. Utilities would need to suitably re-orient their business operations such as addition of a new consumer, increase of load of a consumer or disconnection of the consumer with the database, which has come up as a result of consumer indexing to make it really useful for all times to come. The efforts in this direction have been only limited and require clear understanding of the issues involved in addition to the will of the management to change to business operations taking cutting edge staff on board. Some utilities have also taken up this work beyond urban locations and have used existing available maps at a reasonably lower cost.

  Metering, Billing and Collection: Some utilities are trying out better technologies for metering such as **AMR** and **RMR** (about which you will study in Block 4 of BEE-001) and their case studies are given in this block. The experience of remote meter reading has been mixed. While some utilities have been successful in RMR, many of them are still not finding it very easy. Some utilities have also been able to integrate Remote Meter Reading with the billing process which has further streamlined their operations. While the potential to read the meters remotely for the HT consumes has been attempted by many Indian distribution utilities, the same has not happened with respect to the consumers of other categories.

  Technology is available today which not only allows meter reading of relatively low paying consumers remotely but also offers broadband services to them. Cost of using such technologies is also not prohibitive

and the days are not far off when Indian distribution utilities start working significantly in this area looking for convergence with sectors like telecom and other service providers.

In fact, the attempt is already on to develop low cost meters which would act as relays or would use a network of meters to provide a last mile reading. This, when successful, would significantly reduce cost significantly. With the use of such technology, consumers can be offered broadband service including telephone in addition to many other services. There have already been many successful pilots in this area in South East Asia and Western World in the recent past.

With increased focus on metering at various levels, **metering of Distribution Transformers** has also been taken up by a large number of utilities. Distribution transformer metering has helped utilities identify the loss making areas much more clearly and thus is extremely crucial in controlling T&D losses. The first pre-requisite to DT metering is to ensure that all consumers are tagged with a distribution transformer clearly and accurately. The various models available for DT metering vary from conventional LT CT based metering to smarter built in CT type meters. Different technologies are available in the market to read such meters which include RF and GSM. Utilities need to clearly understand the merits and demerits of various options and the cost involved while making a selection for a particular technology. We shall take up the details of IT applications for this purpose in the next unit.

You have learnt from the experience of various utilities shared in the previous section how the use of IT in billing and collection can help in increased revenue collection and improved customer service. With the use of IT and computerised billing database, many utilities have been able to bring considerable improvement in the collection system especially in the urban areas. Some of the Indian utilities have gone for intelligent cash and cheque collection machines like ATMs which has made the whole exercise of dues deposit extremely user friendly.

However, deposit of electricity bills is not a pleasant exercise in most places even now. Long queues, limited hours and last minute receipt of bills are a common feature in the Indian scenario. The situation in the rural areas is particularly bad. Some utilities, in fact, send their staff or hired agency to collect the dues on fixed dates for fixed time from the rural consumers. Most Indian utilities have a cash collection system wherein bills of a particular sub-division may be deposited in that particular sub-division only. This barrier needs to be broken without further delay.

IT has played significant role in breaking this barrier in many utilities. The payments through Internet, SMS and over phone have already been attempted by some Indian utilities. There are already a good number of agencies in the market which are providing such services to the utilities at a very reasonable cost.

It, therefore, appears appropriate that utilities do not unnecessarily spend money on creating infrastructure at their own level but outsource such services which would not only give the consumers quality services but would also help utilities save avoidable expenditure. Utilities may also try due collection of other public utilities services such as telephone, cell phone, drinking water supply department, etc. through their counters which would help their customers in depositing all their dues at one point. This would also help distribution utilities to increase the revenue and get shorter payback period on the investment made in this area.

- **Energy Audit and Accounting:** The importance of putting meters at all possible points in the network and carrying out energy audit exercise needs no emphasis. Most utilities have taken up this quite seriously and have been able to identify problem areas. Some utilities are carrying out energy audit using their own staff, while some have outsourced this operation. One of the common problems many utilities face while conducting energy audits is wrong indexing and tagging of the consumers to the appropriate feeder which leads to feeder-wise losses to either sub-zero level or a level beyond 100%. The utilities, therefore, need to be very serious about proper coding, indexing and tagging of the consumers if full benefit of the energy audit is to be availed. Till such time as the utilities are able to do this with a high level of accuracy, it would be difficult for them to fix responsibility on the feeder managers having high losses.

  Some utilities have made substantial efforts in using the energy audit results to plan future investments and take up works like laying HVDS, Aerial Bunched Cables and conducting vigilance raids, which have helped them reduce losses significantly. In view of the ever-increasing demand of more supply from agriculture sectors and heavy losses involved, there is always a tussle between the utility and the consumers on the issue. Although utilities claim that they are supplying power for announced number of hours to the agricultural sector, they face constant accusation that the same is not happening.

  Since energy audit results are obtained by reading feeder meters, power supply duration (in hours) for each feeder may also be obtained regularly by the utilities. It is, therefore, logical that utilities make this data for all 11 kV feeders available to the public on a regular basis. Some utilities have tried to host this data on their website which has helped them lower the criticism significantly. It has also been helpful in checking unauthorised supply to loss making areas and has helped in improving the financial situation. The data downloaded for energy audit may also be used for working out reliability indices for important towns and cities and may help the top management focus on the problem area much more objectively.

- **Material and Asset Management:** Most Indian utilities procure a large variety of items on a regular basis and despite that continuously face a problem of matching material in field. IT can play a significant role in not only timely procurement of items but also help utilities track various items

in the field. While some utilities have been able to computerize their stores and have been able to network the same, it is yet to happen in most Indian utilities.

The need of the hour, therefore, is to ensure that the stores are computerized and networked so that the field level officers can check the availability of materials at various locations and get the required material in time. This would also help in ensuring timely procurement of items in addition to lesser lock-in period of the capital. While some Indian utilities have been able to track transformers in a limited way, most other items being procured remain untracked. This results in a situation wherein an item that failed within the guarantee period is not sent to the concerned firm within due time. Procurement, inventory management and asset tracking systems, if properly computerised, would help utilities significantly. Such measures would also lead to better financial management in the utilities.

At present, most utilities have a system of asset tracking and monitoring of each major asset, i.e., transformer, switch gears, etc. History cards are issued along with first time issue of all the new equipment with details. However, currently, this system is not being practiced fully because of increased number of assets, consumers and larger administrative areas. There are gaps and the subsequent history is not being followed. Wherever the card system is being followed, it is difficult to retrieve these cards.

You will agree that it is necessary to control the quality of all major equipment to run the utility effectively and efficiently. Therefore, for critical equipment like transformers, switchgears, etc., the product history from shop floor to commissioning and thereafter till the completion of life cycle should be maintained. With the availability of the history of the equipment, it will be possible to have vendor wise failure rate analysis and the vendor specific possible problems. This will not only help the vendor in maintaining quality standards but also help the utility in bringing down the failure rate. It is also noticed that the conditionality of purchase order is not known to the users in the utility. With timely asset information available, it is possible to plan and deploy the assets at least cost in most efficient manner. All these systems are possible only when IT based Asset Management system is in place in all utilities.

- **Network Management:** Most Indian utilities have large networks in place. There is also an urgent need not only to improve the existing network but also to increase its size to provide better coverage to the citizens. Every Indian utility erects large number of substations and draws substantial length of line every year. Despite the presence of IT in the distribution sector for quite some time, most such important investment decisions are taken without an IT-based decision support system. A good decision support system may help decide the locations of new substations and plan things such as lengths to be re-conductored, locations of installation of capacitors, etc. which would have much smaller payback

period and better rate of return. This would lead to better network management.

- **Sub-division Computerisation:** Sub-division is the most important unit where most of the activities in distribution utilities take place. While there have been significant IT-based interventions in Indian utilities in areas like billing, network analysis, customer relationship management and distribution automation like Supervisory Control and Data Acquisition (SCADA), the efforts to capture various activities at the sub-divisional level have been very limited.

  Very few utilities have been able to computerise activities at the level of sub-division. Since this involves large scale training of the utility staff and procurement of substantial amount of hardware, the same needs to be taken up after thoroughly understanding the issues involved. It would, therefore, be appropriate that the utilities take up pilot projects at the earliest in a few sub-divisions and develop software which can thereafter be used at a larger scale. Since many operations at the sub-division level are utility specific, development of a good software would call for constant interaction between the utility staff and the team developing the software. This requires cent percent involvement and backing of the top management.

- **Substation Automation:** Substation is one of the most important places in the distribution utilities from where supply controls are exercised. In most Indian utilities, staff posted at the substations is not very qualified especially in rural areas. It is, therefore, extremely important that substation automation is taken up by the distribution utilities not only in urban areas but also in the rural areas. While in the urban areas, substation automation has been attempted by a good number of Indian utilities and has been integrated with SCADA, it is yet to take place in most utilities in the rural areas.

  Since this particular item calls for a lot of investment and is highly sophisticated, it is extremely important to clearly understand the issues involved and accordingly choose the right model from the host of products available in the market. Many utilities have gone in for a cheap data acquisition system at the substation level and have been able to obtain the desired benefits like control of supply and check on working of phase splitting devices. It is important that the utilities look at all possible options available in the market and do not get driven by the vendors who try and push utilities to opt for a particular model only listing its advantages.

  Utilities need to clearly assess the amount of supply they are going to make from a particular substation and the number of consumers they are going to serve while opting for a particular model. In the rural areas, utilities can do well by even opting for data acquisition systems which have very little supervisory controls. Many utilities have not been able to provide for basic protection required at substations, say, in the form of circuit breakers. Such utilities need to clearly understand that it is important to provide basics at a substation much before they go in for substation

automation efforts. The smarter SCADA system is available in urban areas to integrate fault management system and is able to help utilities locate faults much more quickly, providing consumers big relief.

- **Customer Relationship Management:** With an increased focus on Customer Relationship Management (CRM), most utilities are trying to establish customer care services at least in the urban areas. While these will be discussed in detail in the next block, we would like to mention the example of call centres and the use of Internet by utilities. Some of the call centres have integrated GPS based consumer indexing database while some are using billing database to identify the calling customers. Many utilities have also started taking complaints over SMS and the Internet. They also and maintain their websites as you have studied in the case studies given in Sec.9.2.

We shall be discussing the Geographic Information System and SCADA in greater detail in the other units of this block. We would like to end this section by presenting a few more case studies of the use of IT by utilities to demonstrate its potential. But you may like to review the information presented so far by attempting the following SAQ.

SAQ 2: Potential for IT interventions

Describe the possible IT interventions in the areas of energy auditing and accounting, material management, consumer indexing and metering.

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9.3.2 Infrastructure for Effective IT Use in the Distribution Business

You may also like to know: **What kind of infrastructure is required for effective use of IT in the power distribution business**?

This aspect may be viewed from different dimensions such as the following:

- **Supporting Reduction of AT&C Losses.**
- **Improving Efficiency.**
- **Revenue Generation.**
- **Creating Organisational Synergy.**

We now briefly discuss the type of IT infrastructure required to serve these purposes.

- **Supporting Reduction of AT&C Losses**

  This needs the placement of the supporting IT-enabled devices at various nodes.

  – **At customer site:** In the form of Electronic Meters/IT enabled conventional meters. Each meter must be capable of storing and interfacing with the utility data loggers for billing purposes.

  – **At DTRs and Pole tops:** Placement of Remote Terminal Units (Fig. 9.3) for polling/transmitting DTR loading and energy data to the substation for performance monitoring as well as energy accounting. (You may like to refer to Unit 2 on Energy Accounting in this course.)

  – **At substations:** Placement of RTUs for database creation, cumulative energy accounting and fault monitoring.

  – **At the master control centre:** Placement of database servers and application servers for processing the various data collected.

  – **Placement of RF/Mobile network devices** for integration with the mobile network besides the utility specific network. This will enable proper accounting of the energy supplied and prompt realization of bills avoiding delays and loss.

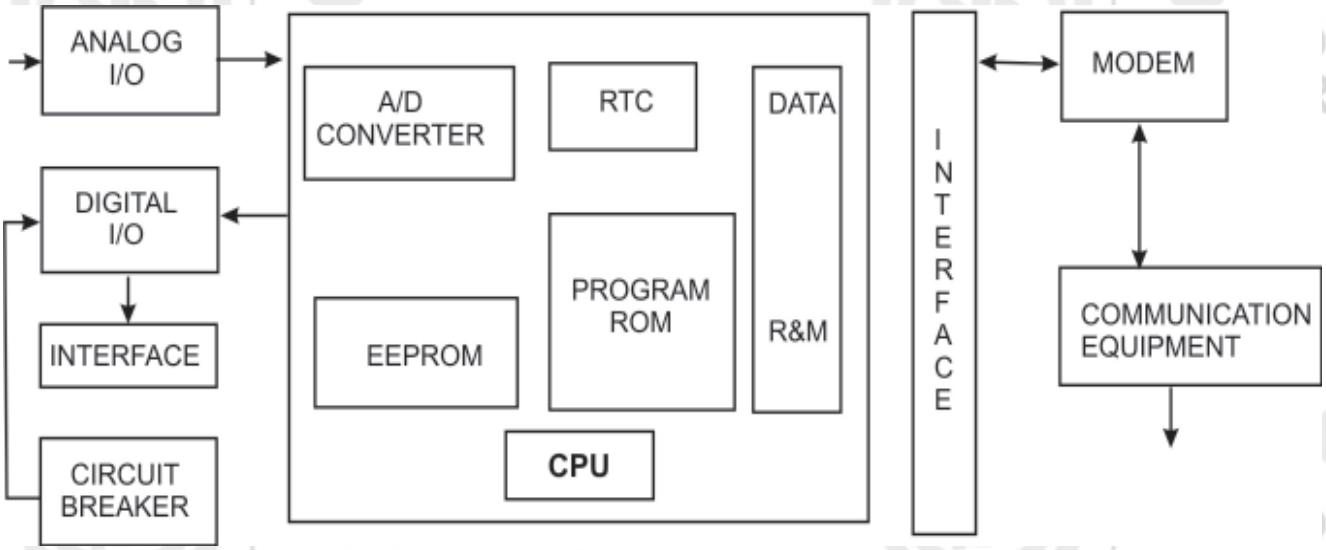

Fig. 9.3: Remote Terminal Unit

- **Efficiency Improvement**

  This may be brought about by the ways discussed in Block 1 of this course. The DTR level monitoring of energy account leads to localization of the problem and thus fixing of accountability and responsibility. Moreover, the placement of RTUs generates the necessary information for control (SCADA) so as to isolate the faulty areas promptly and thus

prevent fault propagation and loss of power to large areas(which would mean revenue loss).

- **Revenue Generation**

  You have learnt in the previous sections how IT can be used for distribution loss reduction through proper metering, billing and collection and corresponding increase in revenue.

  Customer interface may be provided through call centres and websites. The bill collection system is built on a hierarchical basis, with local bill collection centres converging to a master billing centre and thereafter connecting to the administrative setup for decision making. The customers can dialup through **Public Switched Telephone Network** (PSTN) or log in through the World Wide Web (WWW)/Internet and pay his/her bills or register complaints.

  The creation of the IT infrastructure for this purpose involves placement of optical fibres/RF links/hiring of leased lines. Optical fibres have huge bandwidth and data carrying capacity. The requirements of data communication for the utility related data is well handled and leaves spare capacity for onward leasing for other telecom purpose to the third parties.

  This can be used to generate additional revenue. In future, with multiple participants in the market, utilities could even offer tariff incentives to deserving consumers and thus extend their consumer base.

- **Creating Organisational Synergy**

  IT infrastructure brings about the integration of geographically dispersed units of the utility on a virtual platform at a central location, say the Central Office. The customers are interfaced through the Web or the PSTN or RF links and the personnel in various units are interconnected through the Mobile network or other telecom systems. This leads to the instant availability of information for decision-making and thus prevents any delays. The MIS (Management Information System) or ERP (Enterprise Resource Planning) software binds the whole physical infrastructure, human resource and the IT hardware into a single entity exchanging information and ideas, thereby leading to synergistic progress of the organisation.

  Enterprise Resource Planning (ERP) or **Systems, Applications and Products in Data Processing** (SAP) enables effective and efficient project management, financial management and human resource management. This leads to optimal utilization of the assets and minimum blocking of funds thus eliminating wastage of resources. Such optimal utilization is extremely necessary for the utility to survive in the emerging highly competitive market scenario, which the utility has to face. **The Cash Flows and Fund Flows are managed through the software packages integrated with the ERP/SAP**. Several Enterprise Resource Planning (ERP) packages are available for use,like *Energise, PrimeVera, mySAP, Siebel, Synergee* to name a few.

The conceptual IT overlay network for the electricity distribution system could be as shown in Fig.9.4.

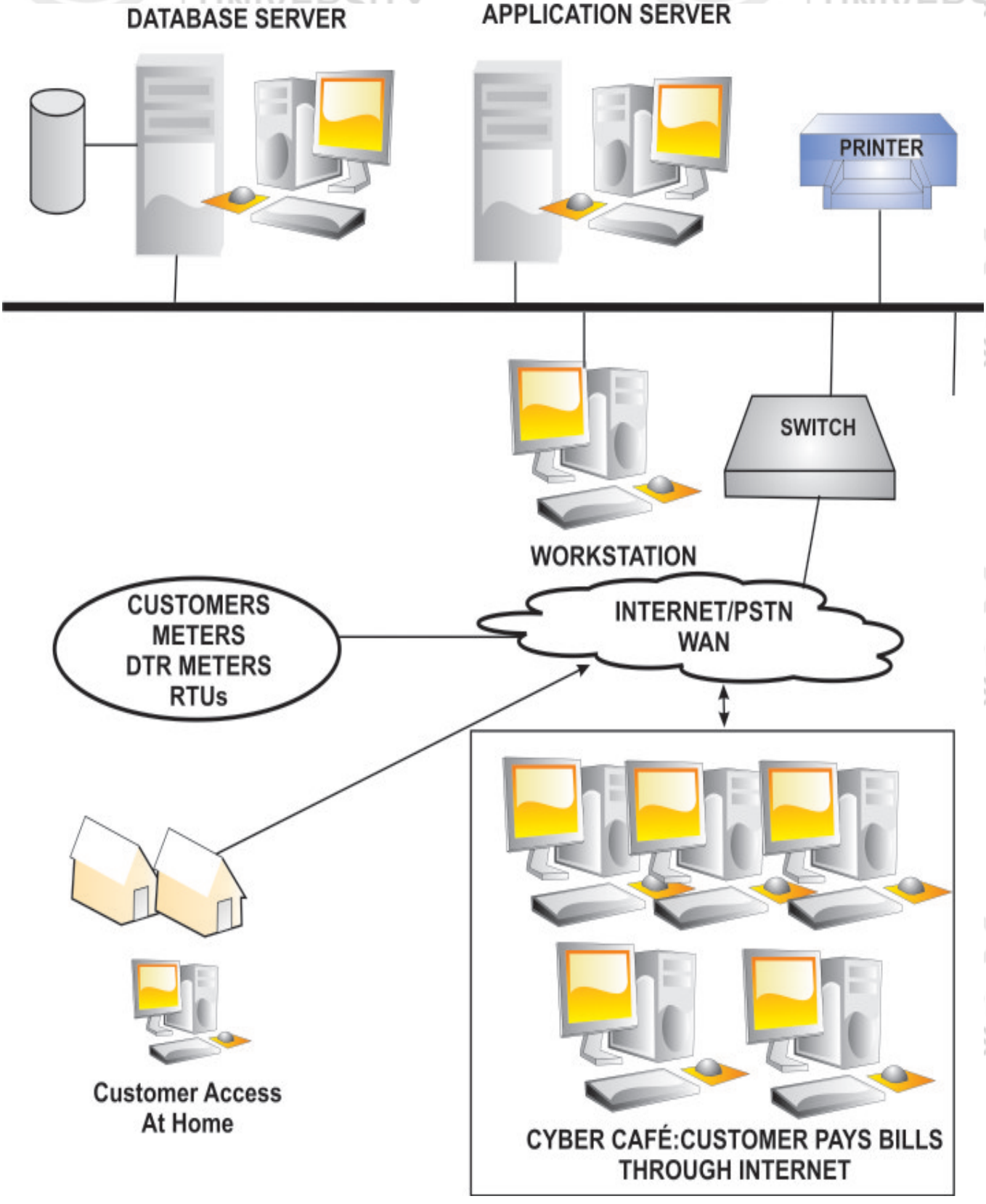

Fig.9.4: Conceptual IT Network for the Distribution System

SAQ 3: IT infrastructure required

Make a list of the IT hardware and software required for running an IT-enabled power distribution business.

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Let us now find out how various utilities have used IT applications.

9.3.3 Case Studies of Successful IT Interventions by Utilities

Power distribution utilities are discovering the pleasure of serving their customers through websites, call centres, remote meters, GIS and SCADA. IT is also helping them in the upkeep of equipment including transformers and switchgears. You have learnt about the IT usage of a few utilities in the previous section. Here, we present a brief description of IT initiatives of some other utilities.

Andhra Pradesh Eastern Power Distribution Company Limited

APEPDCL, the distribution company of AP Transco, is responsible for undertaking distribution and bulk supply of power in five districts and 17 divisions of coastal Andhra Pradesh. A wide area network project has been established at APEPDCL. Consumer indexing is being done through GIS, and ERP is being implemented through SAP modules and billing applications.

The utility has a website which displays bill details of all HT and LT consumers and offers online payment facility. Complaints can also be registered online. It has call centres where all complaints are monitored. A separate IT department initiates, develops and implements the IT applications. The IT Department is headed by a general manager; it is supported by a 30-strong team, including outsourced workforce. In 2005-06, the IT expenditure was about Rs.20 million and the same amount is planned for 2006-07.

BSES Delhi

BSES is responsible for distribution of electricity in two-thirds of the city of Delhi and serves 1.19 million customers. IT is the backbone of the company and supports all its critical operations. To improve performance and become more customer-oriented, BSES is using IT in areas including operations and maintenance, service management, vigilance, administration, human resources, finance, project automation, metering, billing and commercial issues.

Through IT intervention, it aims to increase customer service, ensure the desired levels of asset reliability at lowest possible cost of ownership, make critical decisions based on real-time energy usage information, optimise operations and reduce risks. Focusing on these, BSES has conceived and implemented many IT initiatives over the past few years including a wide range of services offered based on the technology. The company leverages its IT power for several unique initiatives and has developed focused applications targeted at the consumer. For example, an online cash collection system has been introduced. To ensure customer convenience, it has also started running mobile vans for cash collection.

BSES's website is used to extend many services – information on bills and their payment is possible through it. Also, customers can register complaints and check the status. They can also post feedback on the services. A host of bill payment options have also been launched. They can be paid via the Internet through credit or debit cards, ITz cards and electronic clearing service. Easy-to-use bill outlets have also been opened in various parts in Delhi. It is also possible to get bill details through SMS. BSES also operates call centres to address complaints related to metering, billing connection and electricity-related faults.

In addition, several systems and software have been introduced. The operation management system (OMS) monitors and records outages in BSES's distribution area and also supports a 24x7 call centre. The call centre software records and forwards call to a complaint centre and is integrated with the OMS. The recorded data is used by the management for analysis.

Consumer application system is a single-window application for addressing various service needs of consumers. It incorporates two modules, namely, power supply for registering and monitoring applications for new connections and bill amendment, which helps in analysing and rectifying bill discrepancies. The system also incorporates a customer care module through which billing complaints are registered and monitored. The IVRS makes it easy for consumers to have their queries addressed any time of the day.

The utility is effectively utilising IT to improve its key operations. It has deployed SAP modules such as HR, MM, PNM, PS and FICO. It has also implemented SCADA. All administrative activities are computerised. BSES uses Lotus Notes as a messaging media, an electronic document management system for consumer documents and integrated electronic faxes. In future, it hopes to enhance data security, leverage middleware technology, develop a learning management system and integrate GIS, SCADA, AMR and billing.

The IT network is installed at more than 400 locations. BSES boasts of a state-of-the-art data centre and server technologies to support the billing database. There is telecom connectivity at 24 locations with intercom facility. It has also set up processes for monitoring IT operations. In 2005-06, BSES spent about Rs.130 million on IT. The dedicated IT team has total staff strength of 186.

Jaipur Vidyut Vitran Nigam Limited

Jaipur Vidyut Vitran Nigam Limited (JVVNL) engages in the distribution and supply of electricity in 32 districts of Rajasthan. The power supply in the utility is managed by the eight distribution circles, 37 divisions and 152 subdivisions.

IT is increasingly being used at JVVNL to improve commercial and operational performance. A server with local area network (LAN) is available at the corporate office. Computerisation has been carried out up to the division level; it is under implementation at the sub-division level. The utility has established a call centre for redress and monitoring of complaints at all district headquarters. The establishment of consumer service centres up to the sub-division level is being carried out so that consumers can sort out day-to-day grievances related to new connections, billing, metering, line shifting, load extension, etc. Its performance is being monitored according to the standards laid down by the regulator through web-enabled software at all levels.

Computerised billing for consumers of all categories has been provided since 1992. However, the facility is outsourced. Spot billing for total revenue management and decentralised billing up to the sub-division level are being implemented. JVVNL is also implementing SCADA in the city to facilitate monitoring of the sub-transmission and distribution networks. It will also facilitate load management and energy audits up to the distribution transformer level. GIS mapping and consumer indexing are being undertaken for all district headquarters to help the district call centres in identifying consumers, and assisting in asset management and energy audits to identify the high T&D loss areas.

The JVVNL website provides facilities like tender enquiry, spot billing and payment services. There are plans to extend these to consumers from Jaipur and outside. They can also get queries about billing, payment status and the consumption history answered through the website. In addition, the utility has call centres at all district headquarters to track consumer complaints. A consumer service centre for redressal of grievances has also been established. Through a portal provided by the Rajasthan government, Lokmitra centres, e-banking and credit card facility are available in Jaipur and will later be offered in the rest of the state.

The utility's IT initiatives are driven by a separate team at the corporate, circle and division levels consisting of about 30 people. The IT department at the corporate level is headed by an executive engineer and the staff is trained in software design and development, networking as well as data storage management.

The utility has a separate IT budget which runs into several million rupees to implement new initiatives such as spot billing, 11 kV feeder load management, and the global positioning system (GPS) at district headquarters and consumer service centres.

Maharashtra State Electricity Distribution Company Limited

MSEDCL is the state distribution utility formed after unbundling of the Maharashtra State Electricity Board in 2005. MSEDCL has brought in various IT initiatives to improve its performance and be more customer-oriented. It has 10 call centres and another five are ready to start operation. MSEDCL is establishing consumer facilitation centres at its sub-divisional offices. These will provide the necessary services to solve billing complaints, fuse call complaints, release new service connections, etc.

It has also installed "Any Time" payment machines and hand-held spot billing terminals have been introduced in urban areas for residential, commercial and industrial consumers so that bills can be issued on the spot after taking the meter reading.

To implement and integrate these systems, a data centre is being established with a high speed communication backbone. MSEDCL's website – www.mahautility.in – extends many services to consumers. For example, bill information and its payment are possible, as well as application forms for new connections are available on the site. Different kinds of electronic payment options are possible. Consumers no longer need to stand in queue; instead, they can pay via the Internet through HDFC, ICICI and other banks. Bills can also be paid through dotcom companies such as billdesk.com or billjunction.com and through MSEDCL's website by credit card and net banking from banks including ABN Amro, Bank of India, IDBI, Indusland, Punjab National Bank, State Bank of India, Union Bank of India and UTI.

The utility is using various software systems to improve its key operations. A consumer monitoring system has been developed for managing the metering-billing-payment collection cycle at the sub-divisional level. It also helps in energy auditing at the distribution transformer level. So far, an energy audit is being carried out for 50,176 distribution transformers. There is a financial energy management system for energy accounting at the feeder level for calculating losses. Currently, energy accounting is being carried out for 5,504 feeders. The agriculture feeder monitoring system measures the loss level of feeders catering to predominantly unmetered agricultural loads.

As part of its IT initiative, the utility has implemented integrated MIS. The system has six modules in the first phase – system architecture, consumer system, energy accounting, scheme planning and budgetary control, store billing, and finance and loan accounting. Out of these, the consumer system and energy accounting system are now ready for deployment. The second phase consists of the following modules: human resource development, payroll, contributory provident fund system, asset management system, vigilance, legal, estate management, material management and labour, and industrial relations. MSEDCL has implemented SCADA to provide an integrated solution in the distribution system in urban areas in 10 towns. It is integrating automatic meter reading (AMR) of all HT consumers, high-value LT consumers and distribution transformers.

North Delhi Power Limited

NDPL, a joint venture between Tata Power and the Delhi Government serves a customer base of about 910,000 consumers. It has been the frontrunner in implementing power distribution reforms in the city and is acknowledged for its consumer-friendly practices. There is extensive use of IT at NDPL – in metering, network management, customer interface, billing, distributed management, outage management, AMR, emergency management, SMS-enabled call centre software, energy audit, grid MIS, etc. It has implemented technologies such as SCADA and GIS, which has automated the distribution network and helps provide high quality customer services. Moreover, with the introduction of AMR facility, the metering work done by the company is at par with initiatives in the developed world.

NDPL has also undertaken some noteworthy IT initiatives for achieving consumer satisfaction. Innovative applications have been developed in-house to provide end-to-end solutions to manage important functions such as new connections, billing and metering for consumers. It has launched decentralised and bulk billing systems, and prepaid metering for improving billing and collection efficiency apart from ensuring timely and accurate bills.

IT is being used for facilitating customer contact through electricity call centres. To address consumer complaints, it has developed customer relationship management (CRM) software called “Sampark”. It has also opened 12´7 commercial call centres for excellence in customer care. It has launched a scheme called ‘Sakshat’ to display the entire metering and billing data on its website. Now customers can log on and check the entire history of their consumption pattern, calculate their energy requirement, understand various components of the bill and even print duplicate bills. In addition, they can get the bill details through SMS and e-mail, which enhances convenience and transparency.

The company has also introduced a host of payment options – such as payment over the Internet through ICICI Bank, Citibank, HDFC, billjuction.com and billdesk.com; now customers no longer need to stand in long queues. NDPL has also introduced online kiosks at its cash collection centres where payment is possible through credit cards on a 24x7 basis. The company is empowering its key operations through indigenous applications such as “Sugam” (website), “Sarathi” (employee helpdesk), and “Sampark”, among others.

It has implemented SAP solutions for meeting its ERP requirements, through which most of the processes are automated. Sarathi helps in logging requests, grievances, complaints or suggestions of employees. Management reporting has been made faster through implementation of SAP-Business Warehouse and SAP-Strategic enterprise management. The company has many IT networks operating in tandem. It uses technology that supports data, intranet, e-mail, video conferencing, etc. Of these, intranet is the most important tool for bringing about increased productivity and acceptability of IT in the organisation. It covers the entire gamut of operations and functions at NDPL.

There is a knowledge management portal for every employee. Computer-based training and an inbuilt help module has improved awareness and acceptability of IT. At NDPL, IT initiatives are driven by a separate team of professionals, the head of which reports to the technical services head. This person, in turn, updates the chief operating officer. The IT team has different groups, which look after domains such as Application Development and Maintenance, Facility Management, SAP and Quality and Compliance. The IT head is part of NDPL's management team, which defines its overall direction. All major technological decisions are approved by this team.

SAQ 4: Learning from peers

What lessons can you draw for IT use by your own utility from the examples of power utilities given so far? Explain, suggesting concrete measures.

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9.4 ORGANISATIONAL CHANGE MANAGEMENT FOR IT APPLICATIONS

In the previous sections we have described some of the successful IT initiatives taken by a few power distribution utilities. You may like to know: **How were these brought about? What kind of organisational changes were needed to facilitate these changes in the ways of working**? We address these questions in this section.

The pre-requisites that need to be taken care for IT-enabled business to succeed are as follows:

- **Business process re-engineering to make the processes suitable for electronic work flow;**
- **Top Management Commitment; and**
- **Step by step implementation and capacity building.**

We now discuss these prerequisites, in brief.

9.4.1 Business Process Re-Engineering

Let us first consider the prevailing situation. After independence, we adopted the British system and improvements in the system were carried out from time to time to take care of the changing needs. The systems are elaborate and suitable for centralized, manual, ledger-based record keeping in paper form.

With each utility serving over millions of consumers, it has now become extremely difficult to handle this massive information. In order to obtain any information, e.g., about revenue, energy, system, stores, etc., data has to be mined from massive records, which is not always possible. Hence, so far running the distribution business depends mainly on the judgment of individuals who have become islands and control centres of information.

Due to the initial focus on process automation and the absence of a holistic approach, utilities used IT software for individual functions, such as billing, finance, operations, etc. This resulted in stand-alone systems for specific functions, which were vertical in nature. This was in contrast with the business processes, which are horizontal by nature, travelling across functions to deliver value to the intended customer, whether internal or external.

There are many pitfalls of having such stand-alone, non-interactive software deployment (Fig. 9.5). For example, redundancy of data can result in inconsistency, anomaly in updating, revenue loss, as also wastage of resources. With such an approach, customers will not get correct bills or bills *may be delayed for months and sometimes years*. This could be because information from the Application Processing System or the Meter Information System did not move to the billing system.

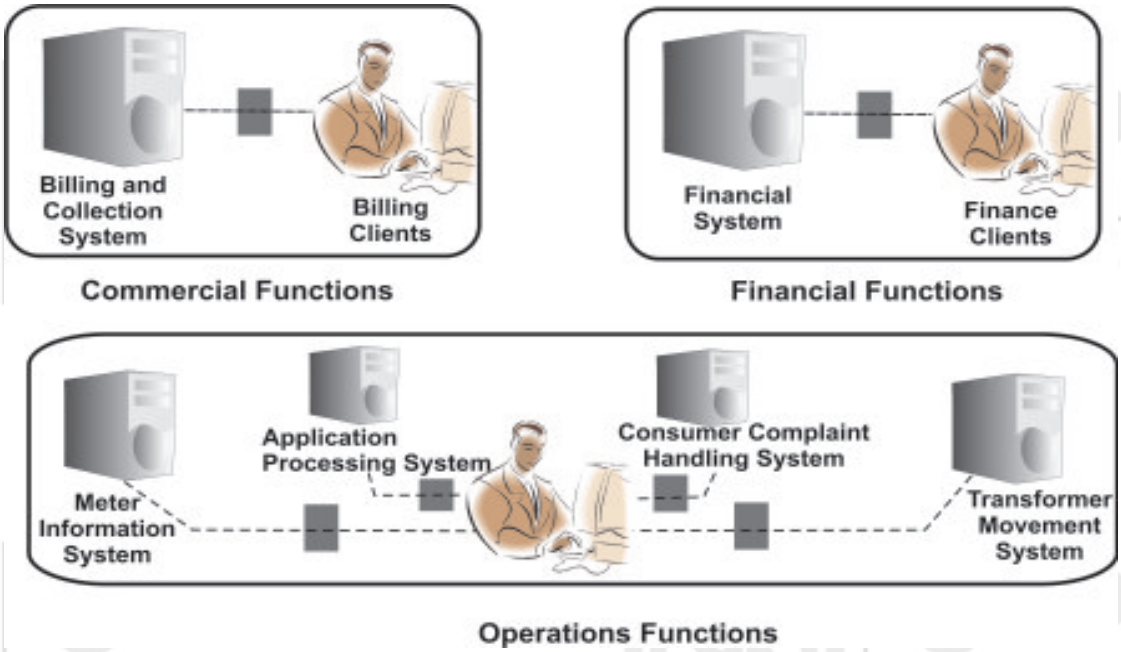

Fig. 9.5: Standalone IT systems for Individual Functions

As the utilities sector opens up to competition, there is an increasingly felt need to revamp traditional business processes to deliver much higher efficiency and effectiveness. The traditional business processes need to be transformed radically to create new innovative and robust models of business in the new environment.

Business processes need to be rationalised and re-engineered so that data can flow seamlessly across functions and information may be created to aid fact-based management of utilities.

In order to make the business process IT- enabled, we need to re-look at the CRM, ERP, Data Management System (DMS) and other generic systems so that even while all departments are working simultaneously in their area they can work with the same database. Further, with technology adoption, the traditional system or administrative powers need to be re-looked, e.g., the practice of manual meter reading needs to be dispensed with when AMR is adopted. Similarly, many more systems for trouble call management, new connections, stores management, bill modifications, etc. need to be changed.

As parameterized software products have gradually gained precedence over custom-built legacy systems, the focus has shifted to integrated information systems, which are more process-centric than traditional approaches towards software development. An integrated IT approach to distribution business management is shown in Fig. 9.6.

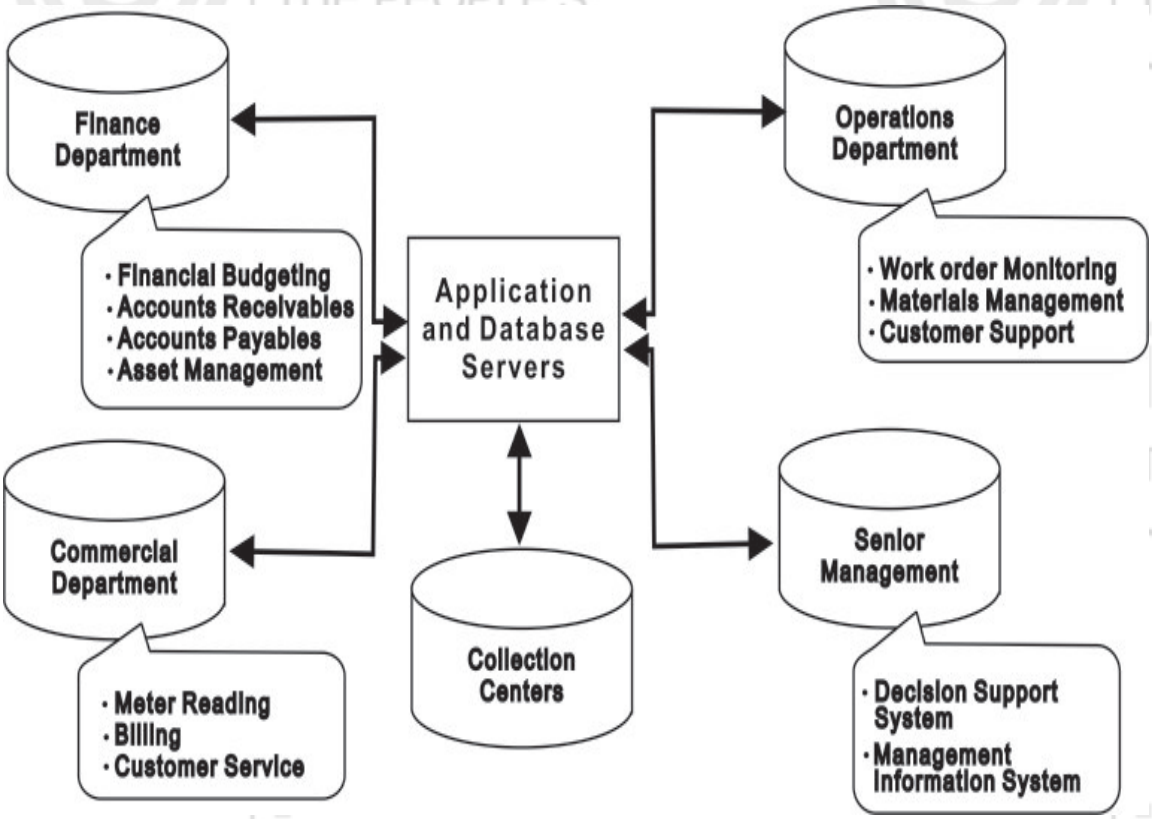

Fig. 9.6: An Integrated IT Approach

Integration in the entire business chain is the key to successful IT deployment as this will lead to:

- holistic, structured approach for deployment of IT;
- enterprise wide application integration and single point once-only data entry for all the processes; and
- cost-effective and fast deployment of constrained resources.

For this purpose, the organisational and administrative hierarchy, delegation of responsibilities and other interface areas with customers, etc., need to be

re-looked into. Any such change would require some time for smooth transition to the new system. Provision for transient support and seamless transition needs to be contemplated and provided.

9.4.2 Top Management Commitment

Any change brings additional efforts to make it acceptable or to ensure minimum comfort level to the people who have got embedded into the prevailing systems and procedures. By nature, human beings are averse to change. Therefore, proper dissemination of information and commitment of top management to push IT initiatives is required. (You may like to revisit Block 2 of BEE-003 on Change Management.)

At present, different utilities in the country are at different level of reforms. IT based interventions vary significantly from utility to utility. While many utilities have clear understanding about the issues involved and have a clear IT roadmap, many other Indian distribution utilities are still trying to implement solutions without any clear road map. In view of the extremely complex web of the activities and their linkages, it is extremely important that IT based interventions are made in a way so that these may later on be integrated with the software being used for other activities in the utility. It is high time that the distribution utilities follow a clear IT roadmap within a definite time schedule.

A proper understanding of various issues involved and the commitment of the top management to this exercise has to be there to have any meaningful IT interventions. Many distribution utilities are trying to cut and paste solutions from western experiences without taking into account the realities at ground and have failed in the process. It is, therefore, important that ground realities be taken into account.

9.4.3 Step by Step Implementation and Capacity Building

Traditionally, the distribution sector worked only in hard wired systems. It had not seen much technological improvement in the work area. The distribution engineers did not have an opportunity to get exposure to technology and, in particular, the Information Technology as they had been bogged down by running day-to-day business in a resource-constrained environment. The expansions in the sector have mostly taken place in the radial mode instead of ring/duplication/alternate route of supply. This has also become a limitation to adopt automation such as SCADA on an immediate basis in majority of our towns.

Considering the current state of health of the distribution network and exposure of distribution personnel to IT, utilities may like to adopt a modular phased approach so that capacity building of the workforce takes place simultaneously to take on the next phase of IT implementation.

In this unit, we have provided you with an overview of the need, scope and potential of IT in the power distribution business, the IT infrastructure required and the organisational changes that need to be managed for successful deployment of IT. We now end this unit and summarise its contents.

9.5 SUMMARY

- The reforms initiated in the power distribution sector in India have underscored the importance of IT use in the sector. IT is needed in the power distribution sector for **supporting reduction of AT&C losses and increase in revenue generation, information exchange for optimal utilisation of resources, improving efficiency of operations and better management of the utilities**.
- **Information Technology** is a term encompassing all forms of technology used to ***Generate, Collect, Transmit, Process, Analyse, Store and Present*** **information** to help users take well informed decisions.
- Therefore, **IT includes signal processing and data acquisition, collection, onward transmission to other locations, storing in data servers, processing of data by applying user friendly applications stored in application servers and finally presenting the result of data processing to the personnel in the form of graphs, charts, tables, alarms, trending, etc.**
- The key areas of IT interventions in distribution business are **consumer indexing, metering, billing and collection, customer relationship management, energy audit and accounting, material management, project management, sub-division computerisation, substation automation**, etc.
- The **IT infrastructure required** in the power distribution business involves the placement of the supporting IT-enabled devices at various nodes, e.g., electronic meters/IT-enabled conventional meters at customer premises, Remote Terminal Units at DTRs and substations, database servers and application servers at Master control centres and RF/Mobile network devices. **Customer interface** may be provided through call centres and websites. The IT infrastructure for this purpose includes placement of optical fibres/RF links/hiring of leased lines. The MIS (Management Information System) or ERP (Enterprise Resource Planning) software binds the whole physical infrastructure, human resource and the IT hardware into a single entity exchanging information and ideas. It also enables effective and efficient project management, financial management and human resource management. **The Cash Flows and Fund Flows are managed through the software packages integrated with the ERP/SAP**.
- **Organisational change management is required to facilitate the use of IT.** In order to succeed, IT enabled business requires **business process re-engineering to make the processes suitable for electronic work flow, commitment of the Top Management** and **step by step implementation and capacity building.**

9.6 TERMINAL QUESTIONS

1. Explain how IT can help in reducing AT&C losses and improving the efficiency of power distribution. Give examples.
2. Describe the role of IT in project management, CRM and improving the operations of a power distribution. Cite relevant case studies.
3. Discuss the changes being brought about by the use of IT in the working of the electricity business.
4. What do you understand by business process re-engineering?
5. Discuss the steps that should be taken for managing the change brought about by the use of IT in organisations.