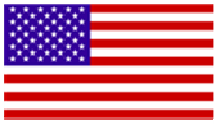


USAID
FROM THE AMERICAN PEOPLE

PAKISTAN-US ENERGY PARTNERSHIP

MULTAN ELECTRIC POWER COMPANY (MEPCO)
OPERATIONAL AUDIT REPORT

Produced by:

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

APRIL 2011

PAKISTAN-US ENERGY PARTNERSHIP

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

MULTAN ELECTRIC POWER COMPANY (MEPCO) OPERATIONAL AUDIT REPORT

ENERGY II IQC CONTRACT EPP-I-00-03-00006
TASK ORDER 13

MWP-USAID Power Distribution improvement Program
House 23, Street 19, F-6/2
Islamabad, Pakistan
Phone: +92 (0) 42 662 2427/8
Email: ddumford@pdip.pk

This report was produced for review by the United States Agency for International Development (USAID). It was prepared by International Resources Group (IRG) for the Power Distribution Improvement Program (PDIP).

TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS

ABC - Aerial Bundled Conductor

ACR – Annual Confidential Report

ADB – Asian Development Bank

AEB – Area Electricity Board (former name for DISCO)

AMR – Automated Meter Reading

BFP – Book of Financial Powers

BOD - Board of Directors

BPS - Basic Pay Scale

CDWP - Central Development Working Party

CE – Chief Engineer

CEO – Chief Executive Officer

CFO – Chief Financial Officer

CIS – Customer Information System

COBOL - Common Business-Oriented Language

CP – Commercial Procedure

CPPA -- Central Power Purchasing Agency

CSO – Customer Services Officer

CSR - Corporate Social Responsibility

CT – Current Transformer

CTC - Circle Training Center

CWIP – Construction Work in Progress

D&S – Design & Standards

DISCO – Distribution Company

DISCOs – Distribution Companies

DOP – Distribution of Power

DP – Distribution Planning

ECNEC - Executive Committee of National Economic Council

ELR – Energy Loss Reduction

ERO - Equipment Removal Order

ERP – Enterprise Resource Planning

FDRANA – Feeder Analysis (Software)

FESCO – Faisalabad Electric Supply Company Limited

GENCO – Generation Company

GEPCO – Gujranwala Electric Power Company Limited

GIS – Geographic Information System

GOP – Government of Pakistan

GST – General Sales Tax

GWh – Gigawatt hour

HESCO - Hyderabad Electric Supply Company Limited

HQ – Headquarter

HR – Human Resource

HT – High tension(11kV)

IA – Internal Audit

ICT – Information Communication Technology

IESCO – Islamabad Electric Supply Company Limited

IPP – Independent Power Producer

IT – Information Technology

KALAMZU book – Meter Reading book

Km – Kilometer

KPIs – Key Performance Indicators

kV – Kilovolt

kVA – Kilovolt Ampere

kVARh - Kilovolt Ampere Reactive per hour

kW – Kilowatt

kWh – Kilowatt hour

LDC – Lower Division Clerk

LESCO - Lahore Electric Supply Company Limited

LPF – Low Power Factor

LS – Line Superintendent

LT – Low tension, (0.4 kV)

M&T - Metering and Testing

MDI - Maximum Demand Indicator

MEPCO – Multan Electric Power Company Limited

MIS – Management Information System

MVAR - Megavolt Ampere Reactive

MW - Megawatt

MWh – Megawatt hour

MWP – Ministry of Water and Power

NADRA – National Database and Registration Authority

NEPRA – National Electric Power Regulatory Authority

NRECA - National Rural Electric Cooperative Association, USA

NTDC – National Transmission and Dispatch Company Limited

PC - Planning Commission

PDIP – Power Distribution Improvement Program

PEL – Pak Elektron Ltd.

PEPCO - Pakistan Electric Power Company Limited

PER - Performance Evaluation Report

PESCO – Peshawar Electric Supply Company Limited

PPRA – Public Procurement Regulatory Authority

PR – Public Relation

PRO – Public Relation Officer

PTCL – Pakistan Telecommunication Corporation

QESCO – Quetta Electric Supply Company Limited

REA - Rural Electrification Administration, USA

RORB – Return On Regulatory Asset Base

RTC - Regional Training Center

SBP – State Bank of Pakistan

SCO - Service Connection Order

SDO – Sub Divisional Officer

SE – Superintending Engineer

USAID – United States Agency for International Development

USC – Use of System Charges

WACC - Weighted Average Cost of Capital

WAPDA – Water and Power Development Authority

XEN – Executive Engineer

1. EXECUTIVE SUMMARY

1.1. OVERVIEW OF THE PROJECT

1.1.1. BACKGROUND

Pakistan's Power Sector is, and has been for many years, beset by significant challenges. These include limited availability of reliable and affordable electric power, aging and inadequate transmission and distribution networks, and utility policies and practices that badly lag behind those of modern utilities elsewhere in the world. Moreover a current-day, technology infrastructure that can enable efficient, back-office operations such as handling customer service requests is not in evidence.

For a major electric distribution utility like the Multan Electric Power Company (MEPCO), these deficiencies translate into a level of financial performance that cannot be considered self-sustaining. And financial self-sufficiency is becoming critical. Pakistan's power industry is undergoing sweeping changes, transitioning from wholly Government-owned utilities to fully autonomous companies that will engage in power generation, transmission and distribution under the Government's aggressive reform agenda. A similar industry structure exists and functions smoothly in many other countries today. In Pakistan's case however, badly outdated policies, procedures and work practices, as well as chronically low levels of investment in utility infrastructure, pose serious barriers to a successful transition.

1.1.2. PURPOSE

The Power Distribution Improvement Program (PDIP) is a three-year, USAID-financed project designed to facilitate improvements in electric power distribution utilities across Pakistan. The project began in September, 2010. PDIP was designed to be implemented in two distinct phases:

- **Component 1** consisted of Operational Audits of each of the eight Government-owned distribution utilities (DISCOs). The purpose of these in-depth operational audits was to establish baseline information that can be used to measure improvement in performance over time. The Audits covered governance, operational, financial, human resources, communications and customer service areas and surfaced opportunities for fundamental improvement in all these. The improvement opportunities identified are reflected in specific Performance Improvement Action Plans.
- **Component 2** will focus on execution of the Performance Improvement Action Plans by each DISCO, including implementation of pilot/demonstration projects to illustrate a number of key operational improvements and directly measure their value to the utility.

Since MEPCO has significant investment through ADB Power Distribution Enhancement Investment Program (Tranche I and II) and through World Bank Electricity Distribution and Transmission Improvement Project (EDTIP), with a strong emphasis on transmission systems, therefore PDIP focuses mainly on distribution system (11kV and below) improvement.

1.2. MAJOR FINDINGS AND CONCLUSIONS

The Operational Audit conducted for MEPCO during Component 1 provided insights into how MEPCO operates, and the performance consequences of the company's current approaches and practices. The PDIP team also became acutely aware of deficiencies that obstruct progress toward improvement. Part of the challenge faced by the utility's management and board in seeking to 'bootstrap' overall performance, enhance customer service, and create greater financial self-sufficiency will be to select the right actions at all levels, from front-line operations to strategic planning, and assign the right priorities. This summary of major

findings culled from the Operational Audit findings contained throughout this report is intended to provide a starting point for management consideration.

Table 1 below highlights major findings and conclusions of Component 1 of this project. Additional, detailed findings can be found in Section 2 of this report.

Governance	MEPCO's governance system has not yet made the transition to a business-like electric utility focus. It remains subject to political intervention, and the Board of Directors has not been empowered to oversee a true corporate entity. Recent reconstitution of the Board by GOP is a positive step toward greater professionalism and operating autonomy; however additional changes will be required to enable it to exert the strategic influence the company will need to succeed in the restructured Pakistani power sector, and to improve its operating and financial performance to more acceptable levels.
Organization	MEPCO's current organization is structured primarily by geographic area and not along functional lines, the latter now seen at most modern electric distribution utilities worldwide. Commercial units responsible for cash flows within the utility should not report to Superintending Engineers whose responsibilities focus on power system stability and reliability. The current arrangement also creates potential conflicts of interest in the performance of key jobs within the utility.
Engineering	Current estimates of transmission losses appear to be slightly on the higher side. Loss levels in the distribution system are extremely high and will require significant effort and financial investment to achieve desired reduction. Detailed modeling of distribution system losses indicates that technical losses on MEPCO's system should be approximately 8.61% of annual energy (kWh). MEPCO reported total system energy losses of 19% in the 2009-10 fiscal year. If transmission losses were 4% as reported by MEPCO/NTDC, the distribution component of loss would be 15%. The difference between the distribution technical loss of 8.61% and a probable total distribution loss of 15% is a non-technical (commercial) loss of 6.39%. This figure is likely to reflect large-scale meter tampering, illegal line taps and meter reading fraud aided and abetted by company employees. Construction and maintenance work practices in widespread use among MEPCO employees are inconsistent, rely on makeshift and stopgap approaches, and suffer from lack of available equipment and transportation access. The consequences of these failures are profound—employee safety is routinely jeopardized; worker productivity is low; response to customer requests can be exceedingly slow; and equipment failures occur more frequently than necessary. All these direct consequences have negative financial impacts for MEPCO.

Financial	The MEPCO collection rate for government clients is much lower than for private clients. There has been no payment made by government on GST amounts due to the DISCOs since the inception of a decentralized GST mechanism in 2008. MEPCO does not have a documented IT strategy which should define the Company's course of action to achieve the business objectives relating to IT in line with the business strategy of the Company. MEPCO's cash flows are impacted by the lack of electronic funds transfer capability on the part of a significant number of organizations operating customer pay points. This situation works against the timely receipt of funds necessary to operate the business. The DISCO also shoulders certain cost burdens rarely if ever seen among leading utilities worldwide. As a result, investment in both distribution system assets and employee equipment is hampered by low capital availability, and operating performance impacted by poor cash flows. A new, rationalized financial framework—covering both internal and external relationships and transactions—is needed to assure better bottom-line performance.
Commercial	Progress toward a modern billing and collections systems is hampered due to the large service territory and a lack of communications between offices and the computer center. The entire revenue cycle, from the setup of new customer accounts to meter reading, receipt of customer payments and ultimate revenue recognition, remains a highly fragmented and manual process. Inadequate monitoring of all steps in the revenue cycle at MEPCO virtually assures negative cash flow impacts, higher than necessary levels of payment arrearages, low customer satisfaction, and delays in completing even the simplest jobs.
Human Resources	MEPCO's corporate culture is akin to that of a government agency in which lifetime employment without performance expectations is balanced by low salaries. This environment makes it difficult for the utility to recruit skilled candidates for open positions since the best candidates command higher salaries in private industry. As a consequence, the company is both overstaffed by any reasonable benchmark and under-resourced, with serious shortages of staff possessing the right mix of technical training, experience and motivation to accomplish its mission. Moreover, the corporate culture requires a complete overhaul to instill in all employees the strategic message that quality of work, responsiveness to customer needs, and constant attention to safety are among the company's highest values.
Communications & Outreach	The practices of internal and external communication at MEPCO are likewise those of a public sector organization, featuring correspondence through staff notes, letters, memos, office circulars, etc. Usage of modern technology is not current. The Public Relations (PR) department is responsible for external communication, with no specified budget and very limited autonomy. The company has not been able to develop a progressive and independent corporate image. Mass media campaigns are managed by PEPCO, with MEPCO only contributing its financial share as a partner DISCO. The role of outreach activities in supplementing media activities for the desired corporate image has not been fully explored.

Table 1: Key Findings of MEPCO Operational Audit.

1.3. KEY RECOMMENDATIONS

Table 2 contains key recommendations of Component 1. Additional, detailed recommendations can be found in Section 3 of this report.

Governance	The Board of Directors should become MEPCO's independent governing body with ultimate decision-making authority. It should be empowered to: 1. Set company policies, performance objectives and strategic directions. 2. Adopt bylaws. 3. Appoint members to its advisory, executive, finance, and other committees. 4. Hire, monitor, evaluate and take correction actions if necessary against the CEO and senior executives.
Organization	A thorough review of organizational structure should be undertaken to evaluate organizational changes required to improve MEPCO'S technical, commercial and overall operational performance. Organizing the utility along functional lines; and establishing lines of authority and responsibility through departments including General and Administration, Commercial Management, Finance, Operations and Maintenance, and Engineering and Planning should be considered. The proposed structure will allow the CEO to focus on strategic issues, leaving day-to-day operational management to qualified senior managers.
Engineering	*Generation of a detailed load forecast.* Load forecasting, when driven by demographic and economic information, can help identify areas where attention is required *Use of GIS for mapping.* GIS for mapping will speed the process of generating useful maps, and eliminate much of the manual labor involved in the current process. It will allow the automated transfer of system information to advance planning software, speeding the production of integrated plans and allowing planning staff to identify areas in which interventions are required for loss reduction. *Selective reconductoring*. The majority of the high conductor loss is to be found in the first 10% of feeder length, where the load is heaviest. Replacement of the commonly used Dog conductor with Osprey would reduce losses by 50% in these segments of line, without the need for bifurcation or addition of new breaker positions. *Review of long feeders (over 60km in total length)* on the basis of voltage drop rather than thermal capacity. The current method of identifying problems only when conductor loading exceeds 300 amps is inappropriate for long rural lines. These circuits have already entered into voltage problems and high losses long before reaching the 300amp threshold. *Preparation of a census of consumer locations.* So that consumers can be linked to the transformers that serve them in the CIS. This would allow for improved transformer load management, as well as providing an opportunity for evaluating losses on a transformer by transformer basis, using portable measuring instruments to correlate transformer loading and sales. *Selective replacement of open wire LT line with multiplex or ABC.* To reduce vulnerability of the system to casual hooking. A side benefit of this action would be a reduction in the incidence of transformer damage due to short circuits occurring on the open wire LT.

Financial	MEPCO's greatest financial vulnerability centers on its relationship with government clients. Given the unlikely chance of the DISCO achieving higher collection rates from this class of customer, the recommended solution is to negotiate tax payment offsets under which unpaid bills are discounted from collections of local and federal taxes. In addition a new financial framework is needed within MEPCO, and should include: 1. Updated accounting and internal audit procedures that more effectively serve the needs of the Board of Directors. 2. Improved transfers from external pay points to MEPCO bank accounts. 3. Complete implementation of an ERP platform, and expand applications to serve all finance and accounting needs in line with control, management, and financial reporting to the BOD, NEPRA, and the Ministry of Water and Power (MWP) as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization. 4. Insurance coverage for buildings, equipment, inventories and other assets as deemed necessary, to eliminate exposure to significant financial loss. 5. MEPCO should develop a ten year financial forecast model, and appropriate training, for its business planning purposes
Commercial	Commercial management is the fulcrum of successful electric distribution utilities; if commercial practices and procedures are not carefully designed, and implemented with discipline and integrity, the financial viability of the utility will be at risk. MEPCO's business processes for customer service / revenue cycle should be systematically improved for increased revenue recovery, improved commercial efficiency, and effective consumer service with: 1. A consumer census to verify/add consumers. 2. Installation of a new CIS. 3. Corporate reorganization so that all commercial units report to the Director Consumer Services. 4. Updated metering, using automated metering technology where appropriate. 5. Reorganized and updated meter reading routes. 6. Implementation of energy accounting. 7. Design of more comprehensive customer service and consumer awareness programs. 8. Enforcement of meter reading audits and meter inspection programs. 9. Establishment of a program of systematic meter repair, testing, and calibration.
Human Resources	MEPCO's management should strive to create a corporate environment and employment conditions that enable *all* employees to: 1. Always know what the company's key goals are. 2. Understand their roles in the organization and how they contribute to the company's success. 3. Have the appropriate level of authority needed to manage assigned tasks. 4. Have access to the equipment, support, and training necessary to succeed. 5. Be fairly compensated for their work supplemented by adequate benefits. 6. Feel engaged with their positions and with the company as their institutional home.

Communications & Outreach	To transform MEPCO into an effective service delivery organization, it is imperative to improve and strengthen its internal and external communications and outreach. It is recommended that the company should: 1. Develop a comprehensive communications strategy to transform and strengthen internal as well as external communications policies and practices. 2. Endow the existing PR department with financial and decision-making authority, to carry out communications and outreach campaigns towards an improved corporate and consumer-centric image for the company. 3. Implement a plan to promote ICT-enabled correspondence to establish efficient systems. 4. Set up the Intranet for record keeping and information management. 5. Develop a corporate branding manual, and guidelines for promoting an independent and progressive brand image for the company. 6. Prepare an Annual Calendar of communications and outreach activities for consumer awareness, integration of corporate issues of theft control, energy conservation, etc. Seminars, public dialogue, press shows, radio talk shows, and collaborative events are some activities to be carried out on a regular basis. 7. Develop a plan to upgrade Customer Centers into service-friendly spaces for consumers. 8. Upgrade the web page into an interactive web portal and ensure its regular maintenance.

Table 2: Key Recommendations Resulting from MEPCO Operational Audits.

1.4. STRATEGIC DIRECTIONS

The value inherent in this report comes from its approach—a thorough and independent Operational Audit of all key areas of the company—and its candor. By speaking directly and without nuance to the array of problems MEPCO faces today, it lays bare what is wrong and what should be considered by utility management to address identified issues and deficiencies. The obvious downside of trying to address this many problems is that the "wood may be lost for the trees." Several management approaches can help counter this.

1.4.1. THE IMPORTANCE OF A STRATEGIC PLAN

A strategic plan is the best way to manage complex change, overcome complacency, galvanize the organization and gradually alter course. Creating such a plan for MEPCO, adopting long term goals, and ensuring that all employees understand them will create a shared awareness and, even more importantly, shared accountability. Every employee should know what is important to the company, where improvement is needed, what they can do to help, and how progress will be measured. Without a strategic plan, it is hard to imagine how management can succeed in addressing the problems highlighted in this report, many of which have persisted for decades. A small number of long-term goals typically form the basis of this plan. Meet an ambitious benchmark for power reliability, achieve a highly favorable customer satisfaction level, or achieve financial self-sufficiency for both operating and investment capital by a certain year—these are typical of goals that have been adopted by other major electric distribution companies around the world.

1.4.2. BENCHMARKING TO MEASURE PROGRESS

MEPCO is in an ideal position to measure its changing performance objectively to judge whether its strategies are working. As one of eight Pakistani DISCOS, the company can compare its measured performance against a group of its peers within a common industry setting. Suitable benchmarking measures may include typical bill (cost for first 500 kWh of monthly service), ratio of employees to customers served,

debt-to-equity ratio, and other widely used and generally available utility statistics. Long-term targets for improvement in any area should however come from high-performing utilities of comparable size and customer mix outside Pakistan. Several utility benchmarking organizations routinely publish such data for their subscribers.

1.5. CRITICAL SUCCESS FACTORS

Numerous barriers stand in the way of MEPCO improving its operating performance and becoming financially self-sufficient. These may include complacency or resistance to change, policies that work against new approaches, lack of convincing leadership, or simply inadequate resources. However, some of these barriers carry special importance for a company like MEPCO and overcoming them will be critical to success.

1.5.1. APPROPRIATE USE OF TECHNOLOGY

MEPCO's business processes are based heavily on manual processing, supplemented by information technology components that are legacies of the 1980's. While business procedures themselves may be reasonable, the growth of the utility has outstripped the ability of staff to perform many of the checks and balances built into the manual system, allowing for errors and potential manipulation of results. Moreover, time required to complete even the most routine customer requests, such as new account setup, is excessive.

It is evident that automation technology can play a major role in helping MEPCO to leverage better performance. Processes can be streamlined and job tasks automated. However, the company may currently lack the organizational capability to successfully implement more advanced technologies being adopted by leading utilities elsewhere. Employees are not accustomed to learning how to use new systems and adapting their workflows to take full advantage of technology. Familiarity with computers, local area networks, and common desktop software is severely limited. Procedures that accompany technology-enabled business processes, e.g. backups & system modification to ensure their robustness, may be unfamiliar territory. *Accordingly, failure to allow sufficient time for rank and file employees to assimilate technology changes and participate in the redesign of their own business processes and work practices would put MEPCO's technology investments at risk and technology projects could create problems rather than solve them.* In the near term therefore, emphasis should be on widely proven technology solutions that automate manual processes, especially in 'back-office' systems such as customer information and full build-out of ERP. More sophisticated uses of technology can come later.

1.5.2. FOSTERING A CORPORATE CULTURE THAT EMBRACES CHANGE

Obviously, setting a course for the future does not necessarily insure that the destination will be reached, or reached safely. In MEPCO's case, nothing short of a dramatic change in corporate culture will be needed. All employees must feel they are valued corporate assets in whom investments such as training will be made, and whose welfare is considered vital. Leading utilities around the world empower their employees to identify problems, help devise solutions, and receive recognition and rewards for doing so. These global leaders in the power sector have created cultures in which continuous improvement of work practices is the responsibility of every employee, and no problem is too small to receive specific attention. Empowering MEPCO's employees to participate meaningfully in the fundamental changes that lie ahead will help spur the move to a new and higher performing corporate culture.

In particular MEPCO leadership, starting with the CEO and Board, must embrace change; accept that incremental improvements will not be enough for the company to keep pace in the rapidly changing Pakistani power sector; and present this change to personnel as a positive force, to the extent that employees see their leadership working to address the needs documented in this report as a welcome and long overdue experience.

1.6. HOW THIS REPORT IS ORGANIZED

The main body of this report is organized in a way that is intended to highlight current challenges MEPCO faces, and identify actions that can be taken to address them.

- Section 1 provides essential background on the utility industry setting in Pakistan, on Pakistani electric distribution companies in general, and on MEPCO in particular.
- Section 2 contains results of the Operational Audit in all functional areas, with bulleted summaries of findings in the front of each sub-section, followed by analysis and discussion.
- Section 3 provides recommendations to address current needs and improve operating performance. Key recommendations have been brought forward to focus attention and facilitate action.
- A detailed description of the PDIP audit methodology is provided in the Appendix.

2. INTRODUCTION

2.1. OVERVIEW

The Power Distribution Improvement Program (PDIP) is a USAID-financed project designed to facilitate improvements in electric power distribution utilities in Pakistan that was initiated in September, 2010 with a three-year duration. PDIP was designed to be implemented in two distinct Components, operational audits at each of the eight Government-owned distribution utilities (DISCOs) and development of performance improvement action plans for each DISCO. The second Component will focus on execution of the performance improvement action plans for each DISCO, including implementation of performance improvement projects for operational improvements.

The principal challenge of successful change management for each DISCO lies in transforming the management practices and the basic work culture of the utility to make it an effective, efficient and service oriented organization, including reining in its corrupt elements. The process requires that virtually all employees buy-in to the new, progressive vision of the organization, receive training in new methods of work and have the liberty of putting into practice the new concepts learned. To do this requires the input of intensive, specialized expertise as well as a DISCO management team committed to the change management objective. It also requires the Government of Pakistan (GOP) to create legal and political space for the management of the utility to operate in the most commercially rational manner, especially with full transparency and streamlined funds transfer arrangements within the energy sector.

Key performance improvement targets will be established on a case by case basis with each of the participating DISCOs to form the foundation of each respective Performance Improvement Action Plan, which will be jointly developed taking into account the results of a joint self-task force operational audit of each participating DISCO and other participating GOP entities. The purpose of these operational audits is to establish baseline information required to measure achievements under PDIP and other related programs. The audits will cover the managerial, operational, financial and customer service situation of each DISCO and include the identification of opportunities and methodologies that will be used to reduce technical and non-technical, e.g. commercial, losses and improve network, institutional, management and staff performance.

2.1.1. BACKGROUND

Industry Environment

Pakistan's Power Sector is beset by a number of significant challenges. These include availability of reliable and affordable electric power; modernization of the aging and inadequate transmission and distribution networks; and focusing on effective, efficient system planning, construction, operation and maintenance to achieve business objectives and customer satisfaction. With respect to retailing electric service to consumers, the challenges include control of an increase in unauthorized connections, elimination of collusion between employees and customers to reduce unauthorized use of electricity, and rationalization of retail electricity tariffs; promotion of a cultural change under a more conducive work environment and compensation packages to the employees; and introduction and enforcement of merit based selection of employees. With respect to regulation of service, the challenges include achieving a balance between business and social objectives, improvement of quality of service and technical performance standards, and introduction of advanced technologies.

The Power Sector is currently in a state of transition from the wholly Government-owned utilities to fully autonomous companies in power purchase, generation, transmission, dispatch and distribution. Initially the power sector was run as a monolithic organization under the Water and Power Development Authority (WAPDA). The WAPDA Power Wing provided the line and functional control of the Power Distribution

Wing directing the operation of eight Area Electricity Boards (AEBs) at Lahore, Faisalabad, Gujranwala, Islamabad, Multan, Hyderabad, Peshawar and Quetta. In 1998, WAPDA was restructured along the now familiar lines calling for unbundling of generation, transmission and distribution. The AEBs were converted into stock companies called DISCOS with all the shares held by the government, a regulatory agency was established [NEPRA], and a new entity, the Pakistan Electric Power Company (PEPCO) created to supervise the transition to full autonomy of the DISCOS. Twelve years later, the "transition" continues and autonomy remains an objective rather than a reality.

The government recently established a Transition Committee under the Deputy Chairman Planning Commission and is now working on a reform agenda for the entire power sector. The main objective is to achieve a deregulated power sector with independent power generation companies, a central power purchase agency, a transmission and dispatch company, generation companies (GENCOs) and fully autonomous power distribution companies. The National Electric Power Regulatory Authority (NEPRA) is already overseeing and approving the power tariffs and DISCO quality of service. NEPRA is also developing its role as a regulator and considerable capacity building, legal framework and policy reforms will be required to have a fully functional power sector. The roles of different agencies, although defined, are not properly implemented to enable a fully functional power sector.

The biggest challenge to the power sector is the increasing burden of fossil based power generation at high cost. Past policy decisions, intentional or otherwise, established natural gas with fuel oil backup as the primary power generation fuels. The failure to develop additional gas resources has increased the use of the fuel oil component of the mix, and a decision by the government to protect consumers from the full cost of oil generated power has resulted in an immense subsidy burden on the government. Financing the subsidy was left in part to the DISCOS with the result that a huge (over Rs. 300 billion) circular debt has been created. The continued adherence to building social objectives in the tariff design, huge wastes and inefficiencies, customer non-cooperation, lack of resources for system rehabilitation and expansion, and lack of a well designed and customer friendly renewable and demand side management program is crippling the power sector as a whole. Major changes are needed to make the Pakistan Power Sector healthy again.

Challenges Faced by Power Distribution Companies

Pakistan's Power Distribution Companies (DISCOs) were created as independent, state-owned utilities superseding the old Area Electricity Boards in 1998, with the goal of becoming fully autonomous government corporations after a transition period. While the DISCOs have increased autonomy in comparison with the old AEBs, they do not yet operate as fully autonomous, government-owned corporations. This is indeed one of the objectives of the newly launched electric power sector reform program. Towards this end, the Government of Pakistan (GOP) recently dissolved the Boards of Directors of the DISCOs and is in the process of formulating how the new directors will be selected and appointed. Selection of experienced professionals who are able to govern the DISCOs with integrity and impartiality presents one of the principal challenges towards creating highly functioning electric distribution utilities. The DISCOs must operate as independent companies fully responsible for their business activities according to well established business principles. As wholly-owned GOP corporations, it is not possible to completely prohibit political impact on the governance and operation of the DISCOs but political influence needs, nonetheless, to be minimized to allow these companies to behave as profit-making public service corporations.

DISCO retail tariff petitions are presented to NEPRA for review, evaluation, and final approval. NEPRA is a federal regulatory agency tasked with licensing electric power generation, transmission, and distribution companies, as well as regulating quality of service and evaluation and approval of generation, transmission and distribution tariffs. While NEPRA has the statutory authority to approve tariffs, MWP nonetheless controls the final tariff setting process by notifying the approved tariff to the DISCOs – essentially the MWP concessionaires through a tariff approval process. Given that GOP is highly sensitive to any upward tariff pressures, MWP has not yet approved application of the full cost of service for the DISCOs, nor has it allowed any tariff differences among the various DISCOS, regardless of differences in customer mix.

As a result of the political sensitivity to application of full cost of service tariffs, several DISCOs show negative financial results and will not be financially viable until and unless the tariff structure is adjusted to allow for higher revenue collection. Recent increases in tariffs have resulted in limited improvement in the cash flow of some DISCOs, especially in MEPCO which has a much higher load density and energy sales per km of the distribution network. Application of true cost of service, making profits for reinvestment, and better employee and customer care remain among the principal challenges of the DISCOs.

Due in part to under-recovery of revenues, DISCOs have failed to invest in distribution system upgrades, and suffer from overloaded and deteriorating feeders and distribution transformers, inadequate metering and outdated technology. Automated asset management has not yet been implemented at any of the DISCOs. Preparation of expansion and rehabilitation projects by DISCO engineering departments is undertaken on an ad hoc basis, rather than as part of an integrated, annual planning process.

The organizational structure of the DISCOs is not conducive to smooth and effective utility operations. The policies and procedures need to be realigned to address process inefficiencies, as well as to introduce checks and balances for data integrity and improved financial controls. Realigning the existing manpower to meet future private sector utility operations will need to be directly addressed by each DISCO, but will likely take significant effort due to complications with unions and a significant change in organizational mentality. Bringing the DISCO's organizational and staffing structure in line with efficient and effective private sector utilities will be a great challenge.

The relationships of the DISCOs to the MWP will, without question, need to be realigned. Ideally MWP should establish a Board appointment process that is objective, transparent and non-politically aligned, and thereafter monitor DISCO financial health through an arm's length monitoring process. NEPRA, through its regulatory role, will continue to monitor quality of service and tariff-setting in the normal fashion practiced by regulatory agencies throughout the world. DISCO performance should be the purview of its management and Board of Directors; these are the corporate agents responsible for efficient operation of electric utility operation in well-functioning electric power sector environments worldwide, and this pattern would benefit Pakistan.

2.1.2. PURPOSE OF OPERATIONAL AUDIT AND IMPROVEMENT ACTION PLAN

The objective of the MEPCO Operational Audit was to evaluate the company's performance in engineering, finance, commercial and human resource functionality, as well as to gather and evaluate the baseline data and information that will be used to measure performance improvements in future years. With the goal of measuring the achievements under PDIP, the MEPCO audit covered the managerial, operational, financial and customer service areas and identified opportunities and methodologies that will be used to reduce technical and commercial losses and improve network, organizational, financial, management and staff performance. The Operational Audit provides an objective foundation for MEPCO's Performance Improvement Action Plan.

2.2. MEPCO PROFILE

The Multan Electric Power Company (MEPCO) is a wholly-owned government distribution company with headquarters located in the city of Multan, in Punjab Province. The utility is responsible for supply of electricity to Bahawalpur, Multan, D.G. Khan and Sahiwal divisions. It has boundaries adjoining HESCO in the south, QESCO in the west and LESCO as well as FESCO in the north. Its service territory is spread over about 105,505 sq. km.

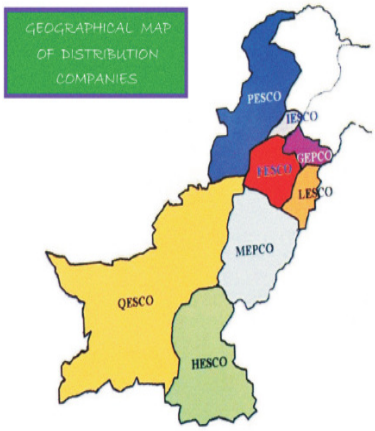


Fig. 1a: Location of DISCOs

Fig. 1b: MEPCO area map

MEPCO has divided its area of responsibility into 8 operation circles, 31 divisions and 145 subdivisions. In addition there are 6 GSO divisions and 8 project construction divisions.

MEPCO CHARACTERISTICS		
No	**Description**	**Value**
1	Administrative Districts Served	13
2	Service Area (km²)	105,505
3.	Operation Circles	8
4	Operation Divisions	31
5	Operation Sub-divisions	145

Table 3: MEPCO CHARACTERISTICS

General description of market

As of 30th June 2010, MEPCO reported more than 4 million connected customers. Approximately 88% of these are domestic. The other predominant category is commercial, comprising about 10%. This is followed by agricultural/tubewell customers accounting for 1.6%. Industrial customers totaled 1.1% of all customers served.

MEPCO CUSTOMER DISTRIBUTION AS OF 30TH JUNE 2010			
No.	**Customer Class**	**Customers**	**Customer Mix %**
1	Domestic	3,554,192	87.60
2	Commercial	394,499	9.72
3	Industrial	42,992	1.06
4	Bulk Supply	395	0.01
5	Tube wells	64,071	1.58
6	Other	1,342	0.03
	Total	**4,057,491**	**100.00**

Source : PEPCO Report on DISCOs Performance Statistics for the year ended June 30, 2010

Table 4: MEPCO Customer Distribution as of 30th June 2010

Reported sales by customer category vary widely from the distribution of consumers. Domestic sales account for 47% of total energy sold, while tubewell and industrial sales amount to 24% and 21% respectively,. Sales to Bulk supply customers equal about 1.5%. Table 1.3 provides a summary of sales by consumer category.

MEPCO SALES FOR 2009-10			
No.	**Customer Class**	**Sales GWH**	**Proportion %**
1.	Domestic	4,655	46.95
2.	Commercial	582	5.87
3.	Industrial	2,091	21.10
4.	Bulk Supply	152	1.53
5.	Tube wells	2399	24.20
6.	Other	35	0.35
	Total	**9,914**	**100.00**

Source : PEPCO Report on DISCOs Performance Statistics for the year ended June 30, 2010

Table 5: MEPCO Sales for 2009-10

Statistical summary, comparison with other DISCOs

Some of the significant performance indicators for MEPCO are shown in Fig. 1.4. MEPCO has distribution losses of 19.0%.

MEPCO 2010 KEY PERFORMANCE INDICATORS

No	Description	Value
1	Transmission & Distribution Losses	19.0%
2	Outages	
	Number of Outages	127,355
	Total Outage Hours	56,823
	Hours per Outage	0.448
3	Transformer Failure (% MVA)	1.6%

Table 6: MEPCO 2010 Key Performance Indicators

MEPCO holds about 20% of the electricity distribution market in Pakistan in terms of number of customer connections but accounts for 15.6% of total energy sold in Pakistan, while contributing about 14.8% to the total revenue billed and 13% to the total revenue collected. So its revenue billing and collection is pretty much in line with its share of sales. The company's HT and LT network is about 23% and 21% of the total length of HT and LT lines. The transformer capacity is about 19% of the total. MEPCO is responsible for about 17% of the sanctioned load, and about 16% of total non-coincident peak demand, of all the DISCOs.

MEPCO FY 2010 STATISTICS			
Description	**All DISCOS***	**MEPCO**	**Share (%)**
Customers	19,582,224	4,057,491	20.72
Sanctioned Load (MW)	47,855	8,249	17.24
Non-Coincident Peak Demand (MW)	19,288	3,006	15.58
Energy Sales (GWh)	63,660	9,914	15.57
Employees	122,530	17,249	14.08
Revenue (Million Rs)			
- Billed to Customers	488,022	72,150	14.78
- Collected from Customers	517,055	67,968	13.15
Receivables from Customers			
- Private	103,351	10,505	10.16
- Government	58,026	1,035	1.78
Total	161,377	11,540	7.15
Distribution Network			
- HT Line (km)	279,990	64,823	23.15
- LT Line (km)	205,020	43,868	21.4
- Dist Trans Capacity (MVA)	32,524	6,079	18.69

Source: PEPCO Report on DISCOs Performance Statistics for Year ended June 30, 2010 (*Nine DISCOs Including TESCO

Table 7: MEPCO FY 2010 Statistics

MEPCO has a slightly higher level of losses as compared to other DISCOs in Punjab province. One reason contributing to this factor can be its large service area and long transmission network. MEPCO accounts for 10% of private and 1.8% of government sector receivables for all DISCOs combined.

There is certainly room for improvement in operational efficiency at MEPCO. In year 2009-10, the utility suffered a net loss of about Rs. 5.7 billion. So any improvement in its performance would significantly alleviate the subsidy burden on the national exchequer.

The purpose of this report is to explore MEPCO's operating practices and procedures, to identify where it should be able to make improvements in operating practices, and to document the specific policies, procedures, and operational practices that will need improvement to contribute to lower operating costs, and improved overall financial & technical performance.

2.3. OVERVIEW OF PDIP AUDIT METHODOLOGY

The PDIP operational audit process was designed to facilitate data collection and to evaluate functional performance in close collaboration with DISCO management. The approach adopted was to evaluate

operating performance by analyzing business processes and practices, and collecting information through one-on-one interviews with DISCO management and employees. The PDIP team not only collected operational data but also reviewed and evaluated management practices and processes to gain insights that could not be gleaned from statistics alone. For example, a key business process for all electric distribution utilities is the commercial revenue cycle – the means by which meters are read, bills are processed and delivered, revenues are collected, and delinquency notices are delivered.

The MEPCO operational audit followed a process similar to audits undertaken of the other seven DISCOs. The process collected and evaluated data for multiple areas of electric distribution operations, including:

- Governance
- Organization
- Engineering
- Financial
- Commercial
- Human Resources
- Communications & Outreach

Comparison of performance indices for MEPCO to those of highly functioning electric distribution utilities outside Pakistan highlighted functional processes that require improvement, while consideration of available best practices allowed the PDIP team to identify high impact performance interventions.

A complete and detailed description of the operational audit methodology followed is provided in the Appendix.

3. RESULTS

3.1. GOVERNANCE

3.1.1. OVERVIEW

The PDIP team evaluated the structure and activities of the Board of Directors of MEPCO to understand exactly how the Board was configured and what level of authority it possessed. Key findings and analysis of that review are contained in this section of the report. On November 22, 2010, all DISCO Boards were dissolved by order of MWP, so many of the PDIP observations presented herein may not be entirely accurate. However, in the interests of identifying potential improvement opportunities, findings of the review will be presented here nonetheless.

3.1.2. SUMMARY OF KEY FINDINGS

The following are key findings of the PDIP review of MEPCO's corporate governance:

- MEPCO's Board has not yet completely fulfilled its governance responsibilities, lacking the expertise and authority to meet challenges facing the company in the changing Pakistani power sector. Board powers are limited and it is unclear whether it has the ability to tackle major issues or oversee strategic change.
- Review of Board meeting minutes indicates that matters discussed are largely routine and of scant strategic significance,
- Declaring its intention to reduce government influence in DISCO governance and move them towards greater operating independence, MWP recently dissolved the MEPCO Board, appointing another in its place.
- Guidelines for the new Board's reconstitution appear to provide a better mix of professionals and stakeholders.

3.1.3. ANALYSIS AND DISCUSSION

The Board of Directors of each DISCO is governed by the Memorandum & Articles of Association, a document reflecting provisions described in the Companies Ordinance of 1984, as amended. The MEPCO BOD consisted of seven Members, including the Chief Executive Officer (CEO). Because the company is wholly owned by the government, MWP appoints all public directors and PEPCO has historically appointed all private directors according to the following formula:

- Four members from the public sector, including the CEO of the utility.
- Two members from the private sector, of which one will be the Chairman.
- One member from the agricultural sector.

All Members are subject to MWP approval. The public members are joint secretary-level civil servants, and the private members likewise have government connections. All serve at the discretion of MWP, and as noted above can be replaced summarily.

The Memorandum and Articles of Association require two Board meetings each fiscal year, with other meetings held at the discretion of the BOD. One of the required meetings is a statutory meeting convened after the end of the fiscal year, to review and approve various items including DISCO state of affairs. This meeting is preparatory in nature to gear Members for the annual general meeting of shareholders, and must take place within four months of fiscal year. The Board has not developed any policies specific to governance of an electric utility in general, or to MEPCO in particular, relying on the requirements of the Companies Ordinance 1984 and the MEPCO Articles of Association.

The previous MEPCO BOD met approximately six times per year and had no formal committees. These standards are somewhat more stringent than required and as a result meet more often to ensure that "important Company business can be reviewed and executed in a timely fashion, as well as to keep up to date with important issues pertaining to MEPCO operation". Review of the Board meeting minutes indicate that matters considered are largely routine, however, pertaining to approvals of procurements and other mundane matters, and that there is little consideration of what might be called strategic issues, which are properly the topics of BOD consideration.

In reality, BOD powers are limited and it is uncertain as to how well the BOD could cope with a requirement to consider strategic issues. For example:

- The appointment and evaluation of the performance of the Chief Executive Officer is perhaps the single most important BOD function in most corporations, but the CEO of MEPCO has historically been appointed by PEPCO.
- Similarly, the entire senior executive cadre of the company has been appointed by PEPCO, rather than being recruited and finally selected by MEPCO senior management.
- Board Members nominated from government agencies were senior in position, and therefore senior in age, resulting in short tenures and high turnover.
- The BOD has no Audit Committee.

In an effort to understand the powers bestowed on the BOD, the Book of Financial Powers (BFP) was reviewed and discussed with the Secretary. The BFP is a governing document and was approved by the BOD in October 2002. It establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by MEPCO management and Board in the operation of day-to-day activities. The Book needs to be reviewed and updated with new dollar amount thresholds and approval authorities consistent with maintaining high corporate governance and internal control standards. Any changes to the BFP currently require approval by PEPCO. It was the conclusion of the PDIP team that the MEPCO BOD had relatively little authority over the company's management and thus could not be considered a true corporate board.

As referred to earlier, by MWP's notification dated 22 November 2010 all DISCOs, GENCOs, and NTDC BODs were dissolved. The order stated the intention to reconstitute the BODs "on professional lines" in accordance with the guidelines of the Cabinet Committee on Reforms, with special emphasis on representation from consumers. Significant effects of the change include:

- That the majority of Directors must come from the private sector.
- That Ministers/Secretaries/Government officials may not be nominated as Chairmen
- That representation from the administrative Ministry/Division be restricted to one.

This is clearly an action intended to reduce the influence of Government in the governance of the DISCOs. The notification should be considered a definitive step towards establishing the DISCOs as more independent public corporations. To serve the DISCOs in a professional manner, the new Directors will

require training, to strengthen their understanding of the role and function of independent boards of directors; and to understand the commercial and technical nature of electric distribution utilities. PEPCO had previously been involved in BOD governance primarily as a manpower transition planning authority for the CEO and senior management of the new DISCOS. In addition it acted as an authority on any proposed positions there. These were roles PEPCO assumed at that formative phase yet never relinquished.

The new MEPCO Board of Directors announced recently by GOP includes: (1) Rehman Naseem, Fazal Group of Industries (2) Shahid Naseem Khokhar Multan Chamber of Commerce & Industry (3) Dr Mujahid Ali, Head Commerce Department, BZU (4) Khalid Masood, Poet and Columnist, (5) Rahat Multaniker, Social Activist & Lecturer English Department, Government Girls College, (6) Aamir Haroon Tangwani, CA (7) Dean University College of Engineering & Technology, BZU (8) Rabia Sultan Gurmani, Farmers Association, (9) Noor Ul Haque Jhandir Mailsi, Agriculturist (10) CEO MEPCO (11) Joint Secretary (Power) MWP, Islamabad (12) Member, Privatization Commission Board.

The new board appears to be a good mix of the most important stakeholders for MEPCO, representing academics, agriculturists, industrialists, members of civil society and the media. While the appointment of the JS (Power) MWP as a Board Member does not violate the law nor the stated objective of limiting representation from the administrative ministry, PDIP nonetheless considers it a step that does not encourage the stated goal of board autonomy and professionalism. This officer holds the line responsibility in the Ministry for supervision of the DISCOS, and his presence on the Board simply reinforces the authority of the Ministry in all matters brought to the Board. Rather than a step in the direction of reconstituting the Board along "professional lines", this appears one in the opposite direction, increasing government control.

3.2. ENGINEERING REVIEW AND ANALYSIS

3.2.1. OVERVIEW

The PDIP review of engineering operations considered four components—transmission system management; distribution system management; mapping and power flow analysis to determine technical and commercial losses; and distribution standards, as described in detail in the Appendix. This section provides the findings and analysis that resulted from this four-pronged engineering review.

MEPCO is a Public Limited Company incorporated in May 1998 as an Electricity Distribution Company with jurisdiction in southern Punjab province, encompassing an area of 105,000 Sq. km. It is the largest utility company in Pakistan, serving a total of 4.0 million consumers and with an annual growth of 5.61 %. MEPCO serves the urban as well as rural areas with 8 operation circles, 31 divisions and 148 sub divisions, with almost 64,824 km of 11kV distribution line, 43,867 km of LT lines, 2,807 km of 132kV and 1,450 km of 66kV transmission lines through 147 grid/substations. Peak demand for FY2009-10 was 2,988 MW, and purchases were 12,239 GWH (PEPCO Report), with aggregate Transmission & Distribution losses of 19%.

MEPCO serves 47 % of power to its domestic customers against 24 % to agricultural consumers and around 21 % to industrial customers including bulk customers through 11 kV distribution network. MEPCO does not employ 33 kV as a distribution voltage, but rather serves all rural areas with 11kV feeders. Rural feeders comprise 57% of the 890 feeders operated by MEPCO.

3.2.2. SUMMARY OF KEY FINDINGS

3.2.2.1. TRANSMISSION SYSTEM MANAGEMENT

The following are key findings of the PDIP review of MEPCO's engineering operations in the area of transmission system management:

- **Network—**MEPCO's transmission network, while moderately loaded and in need of upgrading, is robust and appears to provide adequate service. It is likely to be one of the significant contributors to

total system losses. In fact, a closer focus on managing the company's transmission assets might yield additional funds for investments in distribution.

- **Losses—**Current estimates of transmission losses appear to be slightly on the higher side. Loss levels in the distribution system are extremely high and will require significant effort and financial investment to achieve desired reduction.

3.2.2.2. DISTRIBUTION SYSTEM MANAGEMENT

The PDIP review of distribution system management produced the following key findings:

- **Load forecasting—**A five-year electric load forecast is periodically created by NTDC using a trend-based method and provided to MEPCO for use. This type of load forecast is widely recognized in the industry to have very low usefulness as it cannot reflect changing conditions or economic conditions. Moreover, five years is widely considered to be too short a timeframe for a load forecast given long lead-times for distribution facility planning and construction. The PDIP team found no evidence that the data needed to prepare a more acceptable end-use or econometric forecast were being collected.

- **Feeder mapping**— MEPCO understands the importance of system mapping as a planning tool and has instigated an effort to prepare distribution maps on a systematic basis. Its Planning Department has put considerable effort into the development of system maps through local consultants/contractors. Satellite images for the areas being served by two grid stations have been procured and field survey contracted out. Field survey information is later superimposed on satellite images to generate maps Almost every operations subdivision has its own handmade single line drawings of the feeders in its territory without any geographical reference. The development of a geographic information system (GIS) would provide considerably more capability.

- **Feeder analysis software—**The software used by MEPCO for feeder analysis is obsolete and lacks many of the features found in contemporary distribution analysis software, such as direct input of GIS mapping data, optimization of capacitor placement, analysis of looped systems, modeling of multiple feeders, and graphical presentation of results.

- **National design standards—**Current national design standards do not adequately address congested area construction, causing problems in certain urban areas serviced by MEPCO. However, the company placed an order for a small quantity of LT Aerial Bundled Conductor (ABC) to introduce it in congested areas.

- **Construction quality**—There are no construction inspectors in the Project Division and projects are self-inspected. Each responsible foreman and line superintendent is supposed to inspect 100% of construction under his responsibility. This approach has the predictable effect of uneven quality of construction. Poles were found to be not properly plumb, transformer platforms not level, and sags of conductors not even.

- **Work practices—**Construction and maintenance work practices in widespread use among MEPCO employees are inconsistent, rely on makeshift and stopgap approaches, and suffer from lack of available equipment and transportation access. The consequences of these failures are profound—employee safety is routinely jeopardized; worker productivity is low; response to customer requests can be exceedingly slow; and equipment failures occur more frequently than necessary. All of these direct consequences have negative financial impacts for MEPCO.

- **Safety**— MEPCO suffered a total of 22 lineman accidents, of which 7 were fatal, during the 2009-10 fiscal year. It is highly likely that improved work practices and safety policies could reduce this number, and alter perceptions among the workforce that distribution maintenance and repair work is too dangerous to perform.

- **Meter security**—Meter security was found to be compromised by both the ease with which meter installations can be tampered with and the equally vulnerable service drops. Meter installations in rural areas were especially problematic.

- **Procurement**—MEPCO conducts a large number of procurements annually, often for relatively small dollar amounts. Also, procurement practices that are non-standard effectively preclude international companies from bidding, unnecessarily narrowing the competitive field and obviating potential savings. MEPCO is procuring an unusually large amount of materials this year due to heavy flood damage sustained in Southern Punjab.

3.2.2.3. DISTRIBUTION FEEDER MAPPING AND LOSS SEGREGATION

Below are the key findings of the review of feeder mapping and segregation of technical versus commercial losses:

- Detailed modeling of distribution system losses indicates that technical losses on MEPCO's system should be approximately 8.61% of annual energy (kWh).

- In contrast, MEPCO reported total system energy losses of 19% in the 2009-10 fiscal year. If transmission losses were 4% as reported by MEPCO/NTDC, the distribution component of loss would be 15%. The difference between the distribution technical loss of 8.61% and a probable total distribution loss 15% is a non-technical (commercial) loss of 6.39%. This figure is likely to reflect meter tampering, illegal line taps and meter reading fraud.

- **Accordingly, a strategic opportunity exists for MEPCO to reduce its commercial losses and significantly improve its financial performance.**

3.2.2.4. DISTRIBUTION STANDARDS

The following are key findings that resulted from visits by the PDIP team to the offices of NTDC, which plays a major role in national standards setting:

- Although there is considerable evidence that new distribution system design standards are required for electric service in congested areas, such as the old cities of Multan, Bahawalpur and Sahiwal, focus was given only to adopting LT Aerial Bundled Conductor (ABC), and no activity is underway to evaluate any other changes required in standards for this purpose.

3.2.3. ANALYSIS AND DISCUSSION

The engineering assessment of MEPCO consists of three components. The first is an evaluation of transmission issues. The transmission system at MEPCO was not seen as a major source of problems and therefore this segment of the evaluation was very limited. The second component is an evaluation of distribution system management resulting from a series of interviews with staff from the Planning and Design, Construction, Operations, and Procurement Departments. During these interviews MEPCO staff responded to the team's questions and provided insight into the technical operations of the utility. These interviews are inevitably colored by the attitudes of the interviewees, as well as the misunderstandings of the interviewers, and should be taken as indicative rather than absolute truth.

The third component consists of a mapping exercise and power flow assessment in which the team attempted to use a sampling technique to segregate distribution losses between technical and non-technical, and between the various components of technical loss. The team attempted to select 11kV feeders that were in the aggregate representative of all MEPCO's feeders, and therefore indicative of the level of technical loss of the entire company. An even smaller subset of low voltage (LT) networks was surveyed in detail, with the objective of identifying the contribution of LT systems to MEPCO corporate technical losses.

3.2.3.1. TRANSMISSION SYSTEM ASSESSMENT

Initial visits indicated that the transmission system, while moderately loaded, and no doubt in need of improvement, was providing adequate service. MEPCO has a transmission network totaling 2,807 km of 132kV and 1,450 66kV line, receiving power from NTDC. There are a total of 147 grid substations. System peak demand is 2,988MW, a figure that is somewhat suppressed by load shedding. This is a robust transmission network, and while it probably has issues of its own, is likely to be one of the significant contributors to system losses.

MEPCO prepares a five year plan covering the requirements of the 132kV and 66kV transmission system, using PSS/E, a widely utilized power flow software, to model the system. Total expenditures during FY 2009-10 for the transmission network (STG) amounted to RS 955 million, as opposed to 710 million for distribution improvements, a relatively balanced approach to both transmission and distribution.

Total system losses in MEPCO during FY2009-10 were 19 %, as reported to NEPRA. A review of the data provided to the team on 11kV feeders indicates that distribution loss was 15 %, leaving 4 % for transmission loss. It was felt by MEPCO's strategic planning unit that a problem exists with metering in the transmission network, potentially either at the NTDC delivery points or at MEPCO's substations. Metering systems at both points are manually read at different times, and both MEPCO staff and the PDIP Engineering team feels that this matter can be addressed at relatively low cost, as will be discussed in a later section.

There was compelling evidence that transmission issues were contributing negatively to the financial performance of MEPCO, and it was decided early in the assessment to focus effort on distribution issues, which were clearly more demanding. MEPCO staff indicated that the transmission losses increased during FY2009-10 by 0.7% from 3.9 % to 4.6% due to export of power to other DISCOs over and above the MEPCO system.

3.2.3.2. DISTRIBUTION SYSTEM ASSESSMENT

3.2.3.2.1. PLANNING AND DESIGN

Planning and design of distribution lines are carried out in the same department under the direction of a Chief Engineer Planning and Design-Distribution. This department is responsible for planning of expansion and improvements to the distribution system, and for designing those improvements so that they can be constructed by the Project Department.

The planning environment at MEPCO can best be described as evolving. Distribution planning has traditionally been carried out in response to identified problems, but efforts are underway to develop new systems and improve old ones, with the goal of developing an integrated distribution plan. Comments on the various components of utility planning are as follows:

3.2.3.2.2. LOAD FORECASTING

A five year load forecast has been prepared. However the determination of what growth percentages to use for the various customer classes is made by NTDC and communicated to the DISCO. No overt efforts at collection of load forecasting data such as population growth, demographics, or historical sales data is carried out by MEPCO. Data on sales by consumer class is supplied to NTDC, but the process is prescriptive once the growth factors have been received, that is the MEPCO staff projects demand and energy requirements at the established growth rates, and then subdivides the resulting load among the various grid substations. The Chief Engineer Planning was aware of the need for adequate load forecasting as a local capability.

3.2.3.2.3. MAPPING

The Chief Engineer Planning clearly understands the importance of system mapping as a planning tool and has instigated an effort to prepare distribution maps on a systematic basis. As a pilot project, two (2) gird stations, 132 kV Bosan Road and 132 kV Khanewal Road with a total of 38 11kV feeders, have been selected for complete mapping. Satellite images for the areas being served

by these grid stations have been procured with 0.6 meter resolution from Quick Bird and the field survey has been contracted out to M/S Barqab Consultants. Field survey information is later superimposed on satellite images to generate maps with each structure and distribution equipment. The resulting maps are used as if they were paper to derive line lengths for system analysis. This system serves the purpose for which it was developed, and is consistent with the limitations of the Feeder Analysis software, which only accepts manual entry of line segment lengths.

For the same investment in effort, the development of a geographic information system (GIS) would provide considerably more capability. Ironically, MEPCO has obtained GIS maps, but none of the mapping staff have been trained. The mapping office has not been equipped with required equipment, such as a large scale plotter or an efficient server machine to house this GIS data. Implementation of a proper GIS would require investment in hardware as well as skilled manpower.

3.2.3.2.4. SYSTEM ANALYSIS

The software used for distribution feeder analysis is called Feeder Analysis (shortened to FDRANA), and was developed during the 1980's under a USAID Power Distribution Program. It operates in MS-DOS and is capable of analysis of a single feeder and its branches, producing a tabular output that assesses voltage drop and calculates losses both for demand and energy. The software can model capacitors and also functions as a work order generation tool, with a database that can produce a material list for new construction. Produced as it was by USAID, the software has no cost to the utility and any number of users can be accommodated. This can however be a problem in that multiple users may have different versions of the same feeder model, leading to confusion during analysis.

While certainly advanced for its time, the software is currently obsolete and lacking in many features found in contemporary distribution analysis software, such as direct input of GIS mapping data, optimization of capacitor placement, analysis of looped systems, modeling of multiple feeders, and graphical presentation of results. It is also extremely laborious to use, as all input is manual and any changes in the system configuration require the creation of a new case, thus inhibiting the incentive to do alternative evaluations. The limitations of this software also make it difficult to do multi-feeder area planning, and exploration of system alternatives that could result in sound distribution expansion, operation and maintenance.

The transmission department of MEPCO, in common with that of other DISCOS, has a license for PSS/E, the software produced by Power Technologies Incorporated and widely used in the US for transmission system analysis. Some consideration was given to using PSS/E for distribution planning, but this was abandoned due to the complexity of the software and the lack of resources to renew software licenses. What is needed is an intermediate solution, that addresses the shortcomings of FDRANA, while still being simple to use and low in cost.

3.2.3.2.5. DESIGN

Design of distribution facilities is governed by standards published by the former WAPDA in the 1960's. These standards are based on HT lines with bare ACSR conductors serving relatively large (100 and 200kVA) transformers installed on overhead platforms, which in turn serve three phase low voltage networks using bare aluminum conductors. In the case of MEPCO, many customers have paid for installation of dedicated transformers ranging in size from 25kVA to 630kVA. In the vast majority of cases these transformers are installed in the same fashion as the public use transformers, i.e. on overhead platforms.

The only significant alterations in these standards since they were established have been the introduction of concrete poles. Prestressed reinforced concrete poles were initially approved, but design is moving toward centrifuged poles due to their higher strength and the resulting ability to carry three circuits. An additional change has been the adoption in the 1980's of the Osprey (556MCM 18/1) conductor for 11kV circuits with heavy electrical loading. Osprey has a current

carrying capacity of 700 amps (13MVA) so should provide considerable capacity. In actuality, the majority of MEPCO's switchgear is limited to 400 amps per phase by the current transformers in the breakers, hence the need to consider circuit adjustment at 300amps. This limitation severely limits the usefulness of the Osprey conductor.

The MEPCO system is very congested in cities, especially in Bahawalnagar, Multan, Bahawalpur and Sahiwal, and the national design standards adequately address the challenges they face. One area which MEPCO has pursued, and which will have a positive and long lasting effect on the utility's operations, is the use of multiplex or aerial bunched conductor (ABC) LT line. This would definitely assist MEPCO in reducing the possibility of unauthorized hooking, or "kunda connections".

3.2.3.2.6. CONSTRUCTION

The mission of the Project Department at MEPCO as stated by the Director is that of execution. He emphasized that the department does neither design nor procurement but is responsible for construction of all distribution facilities in the MEPCO service area. The projects undertaken by this department fall into three categories:

- Those funded from MEPCO's budget for distribution upgrading and loss reduction.
- Those that are part of the Power Distribution Enhancement Investment Program funded by the Asian Development Bank (mainly meter upgrades).
- Those involving deposit-work paid for by others, such as line relocation required by road widening and village electrification.

Village electrification, which amounts to more than 77% of MEPCO's construction activity, is considered deposit work due to the way in which it is carried out. There is no village electrification master plan, so the annual budget does not contain any expenditure for this purpose. Rather, a member of the National or Provincial Assembly identifies an area he/she desires electrified, and obtains the funding from the national or local government for the project according to rapport with the ruling party/govt. in power. According to the rules governing these types of projects, MEPCO can include in the budget for such a project only those amounts necessary to construct the actual line extension. There is no planning study to determine what effects the proposed extension will have on the backbone system, or even whether voltage service will be adequate once the service is constructed. These problems are all left for the DISCO to correct or accommodate during the operational phase.

Projects come to the Project Department pre-designed and with a material list from the Planning and Design department. The Project Department examines the locale of the project and prepares its own material list for drawing on stores. In many cases, according to staff, the total material requirements for a particular project are not available in stores, sometimes missing only a single class of item (bolts or D-irons for example), which then causes a delay in construction.

The Project Department constructs all projects with its own workforce, with the exception of the setting of concrete poles which is contracted out. For ELR and Village Electrification jobs, M/S Barqab approves estimates and verifies BOQ of the field work. The department is self inspecting, i.e. there are no independent construction inspectors as such. As noted before, each responsible foreman and line superintendent is supposed to inspect 100% of the construction, with higher level officers required to inspect declining amounts of the work.

A field inspection of the MEPCO system by the PDIP engineering team indicated that the work was generally well done but lacking in specific items. In particular, even though most of the older installations used connectors, none of the newer projects did. On new projects connections were

wrapped or served, and full tension conductor splices did not use joining sleeves but were served as well. The use of served connections will certainly contribute to overheating in the future.

The Project Director Construction indicated it was also difficult to keep linemen in the division. As soon as they attained their certifications as linemen, they would try to transfer to the Operations Divisions where the work is less strenuous. The Director cited instances in which political influence, sometimes extending upto Ministry level, was used to pressure the reassignment of linemen from the construction to operations divisions.

3.2.3.2.7. OPERATIONS AND MAINTENANCE

The fundamental organizational unit for operations at MEPCO is the subdivision, of which there are 148 in the company, each serving approximately 28,000 consumers. Operations subdivisions are defined geographically by feeder service areas and are grouped into divisions, with approximately five subdivisions per division for a total of 31 operations divisions. Divisions are grouped into circles with approximately five divisions per circle. MEPCO has a total of 8 operations circles. In addition to the operations subdivisions there are other subdivisions for Meters and Testing, as well as for construction.

The principle activities of subdivision staff are as follows:

- Continuity of supply, or repair of system failures.
- Meter reading.
- New connections, but only for direct reading meters. All indirect reading meters (with current transformers) are installed by the Meter and Testing department.
- Disconnection of defaulters for non-payment of bills.
- Line maintenance, including line patrol and rectification of problems, as well as measurement of transformer loading.

Each subdivision typically has approximately 70 staff, of whom roughly 60% are assistant linemen, linemen, or line supervisors, 15% are meter readers and bill delivery staff, 5-10% are complaint center staff, and the remainder are managers or other support staff. It was stated that only about half of the linemen could be depended upon to carry out climbing duties due to age, infirmities and overweight, although this could not be verified.

Each subdivision has a Complaint Center to receive and log complaints, and at least one lineman per shift to respond to them. These centers receive complaints either in person or by telephone, and record the complaint in rough form on notepaper, transferring the information later to a ledger.

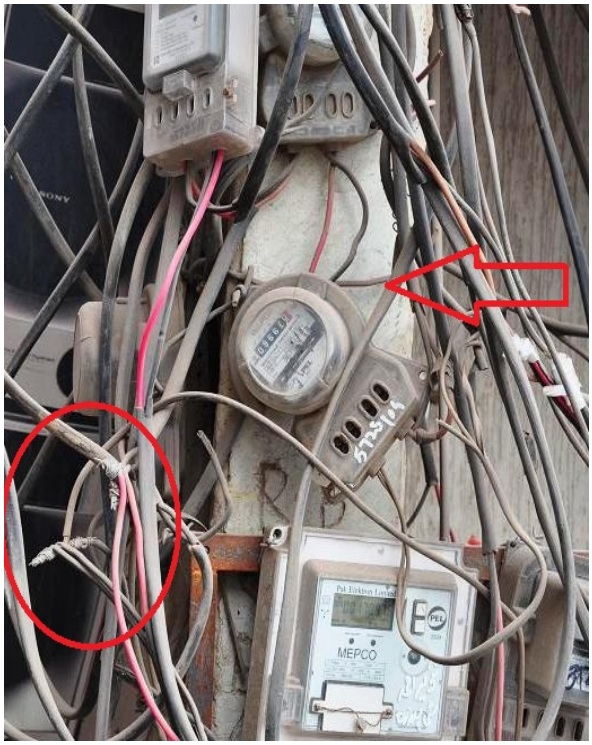
In the subdivision complaint center visited by the PDIP team the lineman on call was waiting in the complaint center to be dispatched. His tools were inspected and found to consist of a hard hat, leather and rubber gloves, a climbing belt, and a collection of hand tools such as pliers and screwdrivers in a small bag. All items were heavily used and the hand tools were in very poor condition, with taped handles and dulled and notched cutting edges. The rubber gloves were for use up to 600V only, but were intact, without punctures or tears. The leather gloves were in very poor condition with holes and wear. If the rubber gloves were actually being used under the leather gloves it is difficult to see how they could be kept in good working condition, so either the rubber gloves are replaced frequently or they are actually not used very often. The latter is more likely.

In addition to the hand tools, the Complaint Center had some larger tools, including a grounding set, fiberglass ladders and various switch sticks and tree trimming hooks. The grounding sets were of a design that simply hangs on the conductor rather than being clamped to it, and would not be

considered adequate for personnel protection. The grounding set inspected had failed at the joint between the three leads, and been repaired by wrapping the joint with aluminum wire. The ladders were fiberglass, of high quality, and in relatively good condition. The switch sticks were generally made with bamboo handles or with pieced together fiberglass handles. Neither type of handle had a surface finish that would be considered adequate for use on high voltage lines. All the switch sticks and ladders were stored in ways and places that exposed them to damage from other items lying against them. The tree trimming hooks were dull and unlikely to be of any use whatever. The subdivision building was very cramped and in poor condition, and the stores area full mainly of junk such as broken insulators, recovered wire and hardware, etc. No doubt some of these items were to be reused to restore service, but there was little new material to be seen.

PDIP's engineering team observed poor installation of energy meters vulnerable for meter tampering and energy theft. Terminal covers over the connections have always been a weak area for energy meters. In theory, a plastic one-way cover is provided with the meter such that once the connections are made, and the cover is pushed in, it cannot be removed without breaking it. Unfortunately, examination of a number of installations on the system indicated that the plastic cover is rarely pushed in, apparently because the connections tend to loosen with thermal cycles and must be periodically retightened. Of course, leaving the connections uncovered makes the meter vulnerable to the most basic forms of tampering.

The installation and the health of the energy meters being used in the field were deplorable. Similarly, the use by the utility of service drop conductors that are neither concentric (protected by a concentric neutral shield against tampering) nor enclosed in a metal mast makes the entire service drop vulnerable to tampering with the cable. The pictures below show a number of meters installed with multifarious opportunities and invitation for tampering, tilting, open terminal covers, even open joints that cannot be considered secure or even safe for the general public in spite of the fact that these are in service. These pictures describe the typical installation witnessed by the PDIP engineering team in Multan city:



Illegal connections are difficult to isolate from this jumble, which is commonly seen. In addition to posing safety hazards these abysmal conditions are best described in the following picture. Similarly, a transformer operating on two phases only is an example of engineering practices in MEPCO.

The subdivision had one or two light vehicles for general transportation, though it was stated that the complaint center lineman and the meter readers used their own motorcycles to transport themselves, or walked. The division office has heavier trucks for transporting transformers, and a crane for setting them. Given the shortage of transport, it is understandable that the trouble center lineman carries only his hand tools when called out. If more extensive work is involved than can be attended to by one man with a pair of pliers, it is necessary to program the work and utilize more personnel. It would be under these circumstances that the heavier tools, ladders, grounding sets etc. would be used.

No regular line patrol/rectification, and transformer load measurement/balancing activity is planned or carried out by the subdivision maintenance staff. Line patrol is carried out as and when a problem is reported.

One of the maintenance objectives of the subdivision is to keep up a log of measurements of loading of transformers, and to periodically rebalance the loads so as to make the full capacity of the transformer available. Transformer load measurements are to be taken twice yearly and recorded in a ledger. Examination of the ledger in the subdivision office visited indicated that no recording of loads had been done for all the transformers in the subdivision on a regular basis. In practice subdivisions normally do not keep up the ledger, and only check the loading of transformers when they suspect that one may be overloaded. This is clearly inadequate and contributes to the poor transformer reliability.

The issue of lineman safety was discussed with division and subdivision staff visited. MEPCO suffered a total of 22 accidents out of which 7 linemen lost their lives during the 2009-10 fiscal year. MEPCO has about 3,400 climbing linemen (classes LM-I and LM-II), not including 5,200 assistant linemen (ALM, who are not allowed to climb poles, and line supervisors.

The approximate distribution of causes for the accidents was reported to be 20% due to electrocutions and 80% due to falls, and most accidents were blamed by management on failure of the linemen to use available protective equipment. In some cases electrocutions were reportedly caused by backfeeds to the low voltage network combined with failure to install earthing sets. The PDIP engineering team visited a construction site where 11kV line was being relocated, and

witnessed the quality of safety measures being observed by the line staff which is evident from the following picture:

Given the high level of lineman accidents, MEPCO is having difficulty convincing assistant linemen to transition to full climbing linemen. Most of the linemen observed by the engineering team to be climbing poles were the older members of the team.

The engineering team observes that issues affecting lineman safety in electric utilities are not unique to MEPCO and usually fall into one of the following categories:

- Personal protective equipment that is either inadequate for the purpose, or difficult or unpleasant to use. The climbing belts and grounding sets used by MEPCO fall into this category. The belts are too narrow and uncomfortable to lean into for any length of time, and the grounding sets are of a design that is completely inadequate for preventing electrocution.

- Shortages of personal protective equipment are such that jobs are attempted even in the absence of equipment. This may be an issue in accidents involving trouble call linemen, as they cannot carry all the necessary equipment with them due to a lack of transport.

- Construction standards do not consider maintenance requirements and do not provide adequate clearances for linemen to work or climb near energized conductors. This should generally not be an issue in MEPCO as WAPDA standards are adequately complied with.

- Inadequate tools for cutting, lifting, and pulling; requiring linemen to exert force, either pulling or pushing that can result in injury if the load shifts unexpectedly.

- Poor tagging and clearance practices. It was reported that some line work is done during load shedding outages, without proper work permits preventing lines from being reenergized.

- Inadequate training in safety practices at lineman training schools. This needs further evaluation.

- Pressure from supervisors to sidestep safety procedures in order to complete work. This was reported at MEPCO staff but needs further examination.

- Poor work planning procedures that do not consider safety a goal of the project.
- Failure to maintain an environment in which safety is emphasized on a daily basis as part of the work schedule.
- Lack of sanctions for staff that knowingly violate safety procedures, and by their example encourage others to do so.

3.2.3.2.8. METER SECURITY

MEPCO has not undertaken a large scale campaign to replace electromechanical meters with electronic units, and approximately 95% of meters remain electromechanical. This means that meter vulnerabilities at MEPCO are the same as they have always been: continual attempts by consumers to disable meters by tilting, dirtying, or otherwise stopping the meter disc; and gradual loss of meter accuracy over time as meters become dirty or are exposed to other hazards. A problem common to both new and old meters is the unauthorized access to meter bottom connections, a perennial risk with A-base meters.

MEPCO's generally high level of losses indicates that these vulnerabilities are indeed an issue, and observation indicated that most meters were not properly attached to the building or bracket and were not upright or clean. Bottom connections on the meters were not covered or sealed, and the utility does not have a meter calibration program, so older meters are likely to be slow. The inspection of the meter fleet indicates that meters are generally not secure in MEPCO territory.

3.2.3.2.9. PROCUREMENT

Procurement is carried out by the Procurement Department. The department prepares a procurement budget based upon the averages of material issues during the previous year, taking into account requests from the Operations Department, and controlled by the available funds. In addition, the budget for new material is developed on the basis of available stock in stores.

Materials are divided among 29 categories according to a legacy WAPDA classification list, although in reality only approximately 19 categories are commonly used. However, each category has sub-classifications which may be separately procured, and solicitations for any given subclass are held twice a year. The result is a large number of solicitations. The largest tenders are for distribution transformers while the smallest are for hardware items.

Most suppliers for items purchased are Pakistani sourced. Although there is no prohibition against foreign suppliers, all suppliers must be prequalified and the process of prequalification, the small size of the procurements, and in some cases the existence of special requirements, tends to limit the interest of foreign vendors. For instance, transformers must be warranted against all hazards whether related to workmanship and materials or not, and damaged units must be replaced rather than credited. This is not a standard international commercial practice and has been accepted only by Pakistani vendors. Procurements for projects funded with donor funds (World Bank, Asian Development Bank etc.) follow different procedures and are handled by the respective Project Management Units.

The Procurement Department is responsible for management of the central warehouse as well as for procurement, but materials pass from the direct control of this department to the Operations Department when they are transferred from central stores to warehouses associated with the operations circles. Once materials are transferred to a circle storehouse, they are generally not available for use in other circles even though a subdivision in a different circle may have needs that cannot be met by the relevant circle storehouse.

3.2.4. DISTRIBUTION FEEDER MAPPING AND LOSS SEGREGATION ANALYSIS

As discussed in the Methodology section, the segregation of technical and non –technical losses for the MEPCO distribution system will be based on power flow models of a sample of the company's feeders. The process calls for selection of feeders on the basis of a consistent sampling method, mapping the feeders using a simplified GIS tool, collection of feeder peak load and power factor data from substation feeder metering, and modeling of the feeders using power flow software.

The intent of the exercise is that the technical losses as determined from this process will then be a valid proxy for the technical losses of the entire system. The difference between the total distribution losses and the technical losses so determined can then be presumed to represent non-technical (administrative and commercial) losses. Further, the power flow model will allow segregation of technical loss between 11kV lines, distribution transformers, LT networks and service drops.

3.2.4.1. SELECTION OF FEEDERS

According to data provided during its annual business plan presentation in October 2010, MEPCO has 890 11kV feeders, totaling 64,824 km of line. Average feeder length is approximately 73km. There are however many feeders both considerably longer and shorter than this value, with different combinations of consumer load types. Clearly, in order to select a sample of feeders that is representative of the utility feeder population as a whole, it will be necessary to employ a sampling technique with specific criteria. The criteria chosen were as follows:

- Average feeder length of sample population should be close to the average feeder length of the overall feeder population.
- Distribution of sales in kWh/year between domestic, commercial, industrial, agricultural and other consumers for the population of sample feeders should be close to that of the overall MEPCO feeder population.
- The proportion of rural and urban consumers in the sample feeders should be similar to that in the system as a whole.
- The sample feeders should have complete data, including total sales and feeder input data, and total length. Feeders with data anomalies would be excluded.

Data was obtained from MEPCO on the entire feeder database. Because its CIS links customers to the feeder that serves them, it is possible to obtain data on sales by feeder and this was also requested. MEPCO feeders are classified as to whether they are urban (U), rural (R), industrial (I), or dedicated (D) to a single consumer. Issues with the data provided are summarized below:

- MEPCO provided data on a total of 890 feeders; however 20 of these had sales of zero for FY2010. This means there are a total 870 active feeders.
- Eighty three (83) feeders have negative losses ranging from -0.06 % to -483 %.
- A total of 26 feeders showed losses of less 10%, whereas 179 feeders showed losses in excess of 20% and less than 30%, 51 feeders showed losses between 30% to 50%, and 35 feeders showed losses above 50%.
- A total of 424 feeders lacked data on length.

The anomalies in the data appear to be due to the slow process for updating feeder information. Feeders that show either negative losses or excessive losses have probably been adjusted in coverage, and the changes not reflected in the CIS.

After excluding feeders with anomalous or missing data, a selection was made using a random number system and tested against the criteria. Initially a total of five (5) feeders emanating from four (4) different grid substations were chosen for mapping A comparison of the characteristics and sales proportions of the selected feeders, compared with the length and sales characteristics of the system, is shown in Table 8 below:

Feeder Name	Length	Demand	Sales MWH				
	km	Amps	Domestic	Commercial	Industrial	Agricultural	Other
Khanewal_Jahangirabad	91.6	288	6,263	269	1,288	2,036	0
Khanewal_Mehar_Shah	133.4	288	7,693	329	1,077	3,498	0
MESCO_Ismailabad	15.7	237	7,884	1,886	737	954	954
Old_Sahiwal_Dera_Rahim	66.6	155	8,267	8,267	1,101	0	2,099
Sample Average	76.8		63.9%	7.6%	10.2%	18.2%	0.0%
MEPCO Average	**72.8**		**61.9%**	**7.7%**	**27.8%**	**2.0%**	**0.5%**

Table 8: Feeders selected for GIS Mapping and analysis

Table 8 shows sales by consumer category for the sample of feeders chosen for mapping. The length of the feeders averages 76.8km, compared with an average length of 72.8km for the system as a whole. The sales breakdown between consumer types for the sample feeders is very close to that of the system as a whole.

3.2.4.2. MAPPING AND MODELING OF FEEDERS AND LT NETWORKS

The feeders were all mapped using a rapid GIS technique that identifies only corner and intersection poles, and poles with equipment installed on them. Observable data such as conductor size, transformer capacity, and transformer status whether general service or dedicated, was noted manually and transferred to an attribute database. Once the circuit was mapped, the information was transferred to a Milsoft Windmil model. This is a standard distribution analysis software used widely in the US and Latin America. Windmil can model single or three phase loads, 60Hz or 50Hz systems, and accepts user information on all conductors and transformer characteristics not in the default database.

The majority of the conductors used at 11kV by MEPCO are Osprey and Dog, with some Panther and Rabbit, all of which are ACSR conductors. LT conductors are mainly Wasp and Ant, which are all aluminum conductors. Characteristics for these conductors were obtained from tables and incorporated into the database. Similarly, MEPCO specifies transformers with maximum allowable levels of losses, a legacy of WAPDA procurement practices. The maximum allowable levels of loss have recently been changed, but none of the new units have been supplied yet. Transformer characteristics used in the model therefore correspond to legacy MEPCO transformer values of no-load and load losses, as shown in Table 9 below:

KVA Rating	10	15	25	50	100	200	400	630
Impedance	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Core Loss (W)	65	85	123	175	310	495	925	1350
Load Loss (W)	320	435	640	1170	2020	3410	5600	8150

Table 9: Transformer Characteristics

It should be noted that these are the values specified in the WAPDA transformer specification DDS-84 for prototype transformers. The standard allows a +15% tolerance in the individual no-load and load loss values of individual production units, and a +10% tolerance in total losses. No attempt was made to incorporate

these tolerances into the model, so it is likely that transformer losses are in reality slightly higher than those indicated.

While Milsoft can accept data on location linked consumer loading, the time available for this project did not permit data on actual loading to be used in the model. Instead, the feeder peak load was obtained from substation records, and this known load was allocated among the various transformers on the basis of transformer capacity, i.e. a transformer of 200kVA was allocated twice as much of the actual feeder demand as a 100kVA transformer.

Another matter to be decided was the level of power factor to be used in the model. Substation meters record kWH and kVARH, from which power factor could be calculated, however only circuit amperes and kWH readings are actually recorded by the substation operators. The engineering team obtained station log sheets from the period around the feeder summer peak. Estimated average hourly power factor was computed by calculating kVA using logged amperes and an assumed bus voltage of 11.5kV and the differences between the hourly kWH meter readings to estimate kW. The result of this calculation is presented in Table 10 below for the sample feeders.

Feeder Name	Power Factor At Max Load %	Power Factor at Min Load %
Khanewal_Jahangirabad	73%	71%
Khanewal_Mehar_Shah	94%	100%
MESCO_Ismailabad	82%	64%
Old_Sahiwal_Dera_Rahim	100%	100%

Table 10: Power factor values for each feeder

It is apparent that power factor for some of the feeders is as low as 64%, while for others it approaches 100%. The preparation of the data indicated that the method used to determine power factor was not entirely satisfactory, probably due to variations resulting from manual reading of the substation meters. Rather than generalize what may be an exceptional value for power factor, and due to the small sample, it was decided to use 80% as the power factor for all feeders in the analysis.

Once the model, loading, and power factor are established the feeder power flow analysis can be carried out. Table 11 below shows the modeling results, disaggregated by line (conductor) loss, and transformer no load and load loss.

Feeder Name	Length km	Peak Demand kW	Line Loss kW	Transformer Loss	
				No-Load kW	Load Loss kW
Khanewal_Jahangirabad	91.6	4,011	419.5	34.0	75.2
Khanewal_Mehar_Shah	133.43	5,165	838.9	53.4	48.7
MESCO_Ismailabad	15.68	3,701	29.6	30.5	37.8
Old_Sahiwal_Dera_Rahim	66.61	2,944	107.2	31.0	21.3

Table 11: Modeling Results for each feeder in MEPCO study

While these results assess the line and transformer losses of the feeders, it is necessary to evaluate the losses of the LT networks and the service drops to obtain a complete picture. Because the number of LT networks on any of the feeders is substantial, it was necessary to carry out a sample survey. A total of five LT networks was mapped and modeled. The process of mapping differed from that used for the 11kV feeders in that for

the LT networks, the mapping included a consumer census of all the consumers fed by the network. In addition, a meter reader accompanied the survey team, carrying with him the meter read route book from June 2010, the month of assumed peak demand. It was therefore possible to obtain and record in the GIS database for the LT network the metered consumption for each consumer.

Since the majority of the consumers located on the LT networks are billed by kWH consumption only, it was necessary to convert the kWH data to demand (kW) for modeling. As no measurements of actual demand were available, it was necessary to estimate demand using only the average energy consumption of the consumers. In order to determine the peak demand in kW likely from consumers on each LT network during the month of June, the data on consumption was applied to the demand equation below. This equation was derived many years ago by the Rural Electrification Administration (REA) in the United States, and has been verified by NRECA as acceptably accurate for use in developing countries as well. The equation is as follows:

$$D = N*(1-0.4N+(N^2+40)^{0.5})\ 0.005925*C^{0.885}$$

Where:

D= Monthly peak demand in kW for a particular group of consumers

N= Number of consumers in the group

C= Average monthly consumption per consumer in kWh/mo.

The demand value calculated by the equation was applied as the source demand for the particular LT network, at the power factor resulting from the HT model, and the demand allocated to the segments of the LT network in proportion to the kWh of the consumers connected to that segment. The result is shown in Table 12 below:

					TOTAL Loss		
Feeder	**Length (km)**	**Transformer Size**	**LT Source Load**	**Source p.f %**	**Kw**	**% Loss**	**W/kVA**
Ismailabad	0.66	200	117	80.7	4.86	4.15%	24.3
Jahangirabad	1.14	200	110	82.7	1.267	1.15%	6.335
	2.00	200	112	82.7	3.03	2.71%	15.15
Meher Shah	1.29	200	82	83.1	0.91	1.11%	4.55
	1.45	200	73	83.1	3.27	4.48%	16.35
Dera Rahim	2.31	100	119	81	2.154	1.81%	21.54
	1.71	200	142	81	4.62	3.25%	23.1
	2.32	100	72	81	0.58	0.81%	5.8
Total	12.88						
				Total Average Loss LT		2.43%	14.8

Table 12: LT Loss for MEPCO Study

The results of the LT analysis show that LT losses vary from 0.81% to 4.48% of the power delivered by the transformer. Average loss for the LT network is 2.43%. The lengths of both urban and rural LT networks were in the order of 1600 meters per transformer, although one of those sampled was only 660 meters. Loading for this group of transformers varied from loads of no more than 37% of capacity to 119% of capacity. Of the transformers chosen, only the one overloaded transformer exceeded 19% of its capacity in June 2010. No attempt was made to assess balance, but it is clear that only relatively few of MEPCO's transformers are likely to be overloaded.

For purposes of this analysis, it is necessary to generalize these results so that they can be applied to all general use transformers on all the modeled feeders, so as to obtain a value for LT losses. A value of average loss of 14.8 watts per kVA of general use transformer capacity was developed. As can be seen, there is considerable variation in the value of this parameter from one transformer sector to another for the urban transformers, and is more uniform for the rural transformers.

3.2.4.3. SERVICE DROP LOSS

Service drop losses were calculated on the basis of the assumption that all domestic sales used single phase meters, while all commercial and direct reading industrial sales used three phase meters. At some time in the past, an effort was made to move meters to the base of the pole as opposed to being mounted on the exterior of the residence. This had the effect of shortening the effective length of the service drop from the utility's standpoint, to something less than 10 meters. Examination of the system indicates that this process has not been completed in many urban areas, and the meters are still located on the exterior of the buildings. For this reason, the average service drop length has been assumed to be 12 meters. Table 13 illustrates the assumptions for the three types of consumer.

CHARACTERISTICS OF SERVICE CONDUCTOR

Consumer Type	Service Wire	Cores	Service Type	Length M
Domestic	7 x 0.052	Two	1 Ph	12
Commercial	7 x 0.052	Four	3 Ph	12
Industrial	19 x 0.052	Four	3 Ph	12
Agricultural	19 x 0.083	Four	3 Ph	12

Table 13: Service drop loss characteristics

Average service loading was determined using the REA equation described above to calculate the total demand of the consumers of each class on each of the modeled feeders. Knowing the number of consumers of each type on the feeder allowed for an average demand per consumer to be calculated. Three phase loads were assumed to be balanced.

3.2.4.4. LOSS SUMMARY AND SEGREGATION ANALYSIS

Once the components of demand loss have been calculated, it is necessary to convert the values derived from demand loss on peak to average energy loss. Because losses are a function of the square of load, it is necessary to account for the variation in load during the course of a year. The standard way in which this is handled is to determine a loss load factor based on the annual load factor of the system. The standard form of this equation is

$$LLF = K*(ALF)^2 + (1-K)*(ALF)$$

Where:

LLF= Loss Load Factor, or the load factor of the on-peak losses

ALF= Average annual load factor for the element under consideration.

K= A constant <1.0 such that loss load factor approximates the results of an analysis of loss curve shape for the system in question. Most common values of K range from 0.7 to 0.9.

The PDIP team used substation log sheet data to estimate the shape of the loss curve for the sample feeders in the MEPCO system. A value of K of 0.84 was found to provide the closest match for the loss curve of the sample feeders. The resulting loss load factor equation is therefore:

$$LLF = 0.84*(ALF)^2 + 0.16*(ALF)$$

Annual load factor was computed for each feeder on the basis of the data supplied by MEPCO and the loss load factor calculated according to the given equation. The same feeder loss load factor was applied to all components of loss. The results for the sampled feeders are shown in Table 14 as follows:

Feeder Type	Conductor Loss %	Transformer Loss %	LT Network Loss %	Service Drop Loss %	Annual Energy Loss %
Total Sample	4.94%	2.62%	0.93%	0.11%	8.61%

Table 14: Summary of losses for MEPCO modeling exercise.

Because the sample was chosen to be representative of MEPCO as a whole, the interpretation of this result is that the technical losses of the MEPCO distribution system are in the range of 8.61%. As noted above, MEPCO had actual distribution system losses of 15.10% in the 2009-10 fiscal year. The difference between the distribution technical loss of 8.61% and the total distribution loss 15 % is a non-technical loss of 6.39%. This is a relatively high proportion of non-technical loss, and can be attributed to the manual systems in place in MEPCO, and needs to be addressed by MEPCO management.

3.2.4.5. VALIDATION

MEPCO, in its report to the Ministry of Water and Power of October 2010 reported total T&D loss of 19 %. The considerable variance with the results is presented here, but nonetheless it was decided to carry out an independent evaluation using a benchmarking technique developed for electric systems in the rural US. Studies conducted by the Rural Utilities Service, the financing and monitoring arm of the US rural electric program have determined that for systems using conductors and voltages typical of good engineering practice, distribution system loss is a complex function mainly of sales density, that is MWH sales per km of line. The equation developed based upon that parameter is as follows:

$$L= (-1.8458*(LN(H7*1.609))+17)$$

Where:

L= Total losses (technical and non-technical) in percent

H7= Sales density in MWH of sales of all types per km of distribution line

LN= Natural logarithm function

For purposes of this analysis, distribution line is considered to include both HT and LT line. The tendency of this equation is to assess higher losses for utilities with lower sales densities, that is, for utilities with dispersed consumers and low sales in MWH/km of distribution line, losses are higher than for utilities with more dense service areas. Thus increasing the amount of distribution line considered tends to increase the allowable level of losses.

Applying this equation to the Pakistan DISCOS results in Table 15 as follows:

DISCO	Total Km	Sales Density MWh/km	Benchmark Loss % at 11kV	Actual Loss Reported by DISCO at 11kV
MEPCO	112,948	87.8	7.9	15%

Table 15: Summary of DISCO loss benchmarks.

It is apparent that, according to this benchmark, MEPCO should have a distribution loss of approximately 7.9%, a value which is slightly lower than the assessment of technical losses presented in this report.

3.2.4.6. TECHNICAL OPPORTUNITIES FOR REDUCTION OF NON-TECHNICAL LOSS

The high loss of MEPCO, both technical as well as administrative, demands concrete efforts to reduce and bring it to an acceptable level. Potential opportunities are as follows:

- Mapping of lines and consumers using a GIS provides important information for use not only in planning, but also in monitoring of transformer loading. Accurate location of consumers with respect to the feeder and transformer that serves them allows for better tracking of feeder losses, and can aid in identifying areas where theft is high, as well as provide a means for evaluating the impact of other improvements.

- Open conductor LT line is notoriously vulnerable to unauthorized hooking or "kunda" connections. Replacement of at least some of the open LT system with covered multiplex conductor would assist in limiting loss from this source.

- The engineering team was advised that approximately 80-85% of MEPCO meters are still of the old electromechanical type, and these are notorious for slowing as they age and for vulnerability to tampering. While wholesale replacement of these meters with electronic units may be more expensive an activity than MEPCO wishes to undertake at the present time, a campaign for calibration of the existing meters would have immediate results at much reduced cost.

- Meter reading improvements that minimize the number of error prone manual transcriptions of data would greatly reduce errors and facilitate the identification of problematic meters for replacement.

Another technical measure that, while having minimal effect on losses will improve customer service and reduce resistance to payment, could be as simple as installation of connectors on all high current joints. The type used should be compression connectors which can in most cases be installed with hand tools. These are also much cheaper and more reliable than bolted connections.

3.3. FINANCIAL

3.3.1. OVERVIEW

The financial management Operational Audit was designed to evaluate the effectiveness and efficiency of financial management at MEPCO. The audit process has been designed to evaluate operational control against standards set by management. Factors included in this process include long term plans, budgets, and operating policies and procedures.

3.3.2. SUMMARY OF KEY FINDINGS

The following are key findings of the PDIP review of MEPCO's financial management.

3.3.2.1. CASH RECEIPTS AND DISBURSEMENTS:

- MEPCO's collection rate of current assessments for government clients – 52.9%, is much lower than it is for private clients – 84.9%. GOP accounting regulations prohibit making provision for past due receivables from government clients, and therefore MEPCO must consider all government receivables as collectible.

- Like all DISCOs, MEPCO is forced to remit payments for GST on all billings, regardless of whether the bills are actually collected. Thus, even though taxes are considered a pass-through, the difference between billed and collected taxes is paid from the company's distribution margin. These taxes represent a significant financial burden.

3.3.2.2. FINANCING AND INVESTMENTS:

- Though MEPCO has total revenues of Rs. 87 billion (~ $US 1 billion) per year, it could only afford to undertake about $78 million of system investment in 2009-10. This level of investment is insufficient to maintain the distribution infrastructure over the long term.

3.3.2.3. INTERNAL CONTROLS:

- Internal Audit only functions as a financial control in the review and certification of certain consumer electricity billings and financial transactions. The external auditor is unable to rely on the work of Internal Audit due to the unit's lack of independence, training and professional expertise. The existing Audit Manual does not address the specific audit procedures that will be required to perform internal auditing procedures in MEPCO's planned ERP environment.

- The Internal Audit Department reports directly to the CEO, with no reporting requirement to the BOD.

- There is considerable lack of training and professional expertise within the Internal Audit unit.

3.3.2.4. COST CONTAINMENT:

MEPCO's vehicle fleet consists of a total of 964 vehicles; 241 of which are 20 years old or older. The company's fleet management policy requires vehicle replacement after ten years, but vehicles are rarely replaced on schedule due to conflicting approval policies. Even if MEPCO were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy which allowing for vehicle replacement . Not surprisingly, older vehicle maintenance costs are significantly higher than those for newer vehicles.

- MEPCO has significant financial vulnerability due to lack of insurance on its facilities. Grid stations and some of the new vehicles are presently the only facilities insured by MEPCO.

- MEPCO is currently paying PEPCO approximately Rs 21.9 million per year as a software license fee for three applications (billing, payroll and inventories). This expense could possibly be reduced if MEPCO embarks on its ERP implementation, and could actually help fund the migration to ERP.

3.3.2.5. FINANCIAL REPORTING:

- MEPCO's ERP project is of great importance and has the potential to make a major impact. The organization has taken no initiative in moving forward with an ERP solution.

- MEPCO continues to use a legacy WAPDA Accounting Manual that has become increasingly outdated due to changes in accounting practices in Pakistan. The MEPCO Finance Director is in the process of updating the manual.

3.3.2.6. FINANCIAL PERFORMANCE:

- Maintenance expense as a percentage of operating revenue indicates that MEPCO is spending significantly less than are the US rural electric cooperatives to maintain its electric system, 1.07% for

the former compared to 7.98% for the latter. However this is partly explained by the fact that MEPCO has higher sales density requiring smaller investments in total utility plant per kilometer of line than the US cooperatives.

- The plant revenue ratio (total utility plant/operating revenue less cost of power) indicates MEPCO has significantly less operating revenue remaining after power costs to support its existing plant through operations and maintenance expense – 32.5, when compared to the US cooperatives – 6.3. A smaller plant revenue ratio indicates higher revenue per unit of investments in plant. The U.S. cooperatives have invested significantly more in total plant per kilometer of line – Rs. 2,622,327, than has MEPCO - Rs. 901,435.

- The amount of trade debt receivables over 60 days as a percentage of operating revenue is slightly higher for MEPCO - .57%, than for the US cooperatives - 0.23%. This comparison is based upon FY 2010 MEPCO trade debt.

- The US rural electric cooperatives' consumer density averages 8 consumers per kilometer, while MEPCO has 63 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while MEPCO's consumer to employee ratio is 251 to 1. Even though MEPCO has the highest average in consumers per employee when compared to other DISCOs, it could improve its financial position significantly by improving its consumer to employee ratio. Were MEPCO able to achieve a consumer to employee ratio close to 467:1, its savings would approach Rs. 1.5 billion per year.

3.3.3. ANALYSIS & DISCUSSION

Financial management responsibilities rest with the entire MEPCO management structure. However, direct responsibility for overseeing financial management lies with the Director Finance who is accountable for cash receipts and disbursements, financing and investment management, internal control, cost containment and financial reporting. This report highlights the important aspects of each of these functional areas.

3.3.3.1. CASH RECEIPTS AND DISBURSEMENTS

MEPCO receives cash from various pay points including banks, post offices and NADRA; the mode of payment includes cash, online banking, and credit cards. All payment collection centers are required to transfer funds collected (net of collection fees) to the respective MEPCO central bank account. MEPCO receives 75% of its deposits in its bank account the same day the payment is made; 14% of deposits, primarily from offline banking, are received within three to four days after payments have been made. The remaining 11% of deposits, received from post offices, also take up to three to four days to be transferred to the utility's primary bank account. MEPCO's deposits are transferred to the central bank account of PEPCO/CPPA after deducting an amount to cover operations and maintenance expenses, a certain distribution margin and applicable taxes. Taxes are paid directly to local, provincial, and central government authorities, while the DISCOs are authorized to employ the distribution margins to finance non-power operating costs. While improvements can be made to improve cash transfers, a significant portion of payment receipts are transferred to the MEPCO account on a timely basis.

It was noted by the Finance Director that on occasion PEPCO requests additional cash from MEPCO's bank account to cover power costs attributable to the GENCOs and/or IPPs which is outside CPPA billing. Currently, excess capacity fuel cost charges can only be passed through on a quarterly basis, while excess energy fuel cost charges are passed thru on a monthly basis. The loss of time it takes to recover excess capacity charges is a cost in the loss of cash flows.

MEPCO's Annual Reports show significant trade debt receivables. The company makes provision for doubtful trade debt accounts using the policy shown in Table 2.9 below:

No	Category	Value (%)

1.	Disconnected consumers	100%
2.	Active consumers 6 months or more overdue	100%

Table 16: Trade debt provisions for delinquent consumers

In fiscal years 2009 and 2010, a provision was recorded as an expense in the amount of Rs. 153,654,416 and Rs. 472,867,300, respectively. In fiscal years 2009 and 2010, the trade debts written off were Rs. 19,147,110 and Rs. 9,208,999 respectively. Provincial and federal trade debts are required to have no provision related to electricity sales, but may make provision for non electricity sales related receivables. Provision expense is included as an operations expense for purposes of Distribution Margin (DM), and the size of the expense may have a limited impact on the amount of DM received. In an analysis of FY 2010 trade debt receivables over 60 days as a % of operating revenue, MEPCO stood at.57% when compared to US rural electric cooperatives at .23%.

Following the assumptions shown in Table 16, MEPCO accumulates provisions for past due accounts receivables under the observation that these accounts are uncollectible. The utility's cumulative total provisions amount to Rs. 2,341,356,931. Given that MEPCO considers these accounts uncollectible, it makes no further attempt to collect them. Alternatively, the company could consider engaging a collection agency to make further attempts at these collections, paying a percentage of the collected total against the targets on a contingency basis.

Additionally, MEPCO receivables from government accounts are at Rs. 5,321,105,899. As already noted MEPCO's current assessment collection rate for government clients at 52.9% is much lower than for private clients at 84.9%. The DISCO does not make any provisions for uncollected government accounts; GOP accounting regulations prohibit MEPCO from making provision for past due receivables from government clients, and the utility is required to consider all government receivables collectible. A legal remedy will be required to force the government to pay past due debts – or perhaps to allow a tax offset against aging, unpaid electric bills.

MEPCO and the other DISCOs are required to retain, and later pay taxes and license fees to local and federal agencies as a function of commercializing electric power. Some of these taxes due to the government are assessed on the basis of electricity sales rather than on receipts against billings. The following describes amounts collected monthly in addition to the consumer electric bill:

- General sales tax (GST) assessed at 17% on all consumers (except some categories exempted by GOP, e.g. export industries, leather manufacturers, etc.)
- Income withholding tax: 5% and 10% retained at for industrial and commercial consumers, respectively.
- Excise duty of 1.5% on all consumers (varies by local jurisdiction).
- A flat fee of Rs. 35 on domestic consumers to support the national television network.
- Surcharges may be assessed as needed to cover the costs of certain power plant projects

Given that GST is levied on the basis of billings, the DISCO is forced to remit payments for this tax on all billings, regardless of whether the bills are actually collected. Thus, even though taxes are considered a pass-through, the difference between billed and collected taxes is paid from the DISCO's distribution margin.

These taxes are netted against GST due and may represent a significant burden for those utilities with low collection rates. However, MEPCO had a net general sales tax receivable of Rs. 2,663,137,111 in FY 2010. There has been no payment made by government on GST amounts due to the DISCOs since the inception of a decentralized GST mechanism.

3.3.3.2. FINANCING AND INVESTMENTS

Electric utilities are capital intensive operations, requiring a regular and dependable stream of long term financing at reasonable rates in order to be able to undertake system improvements when prudent and necessary. MEPCO's financing needs are met from two sources, internal cash generated by the distribution margin, and long term financing arranged through the government. Of the two, the only dependable source is internally generated cash. Long term financing may be typified as World Bank or Asian Development Bank lending, but in reality these funds are actually lent by the donor to GOP who on-lends them to the DISCO. Subject as they are to the geopolitics of government and multilateral bank relations, the availability of such financing is not related to the financial strength or the particular needs of the utility, is always project specific, and cannot be relied upon when needed by the DISCO.

Local banks are not enthusiastic about extending long-term credit to the DISCOS, since as government entities, the utilities are subject to political requirements not always aligned with their individual financial sustainability. For instance as mentioned earlier, in 2008 four DISCOs including MEPCO were asked to obtain loans to pay for government shortfalls in power costs incurred by all DISCOs. A portion of the interest expense incurred on these loans was reimbursed by the GOP.

Generally, cash flow generated by operations is satisfactory only for meeting short term needs, making MEPCO essentially an operations oriented entity. One of the reasons that system planning is so constrained is the shortage and uncertain availability of significant investment funds. Though the company has total revenues of Rs.87 billion ($US 1 billion) per year, it could only reliably undertake $78 million of system investment in 2009-10.

All DISCO investment projects are required to be filed with the Planning Commission (PC), Central Development Working Party (CDWP) and Executive Committee of the National Economic Council (ECNEC) for approval regardless of funding status. Each is evaluated on a cost benefit basis and only projects that have a calculated benefit proceed further for financing. The documentation required for these filings is burdensome regardless of the funding source. The Finance Director would like to see the process streamlined to minimize documentation and reporting requirements, especially for those projects with no government funding.

The weighted average cost of capital (WACC) is used in the computation of rate of return on rate base. It is a blended rate of the cost of debt and the cost of equity. This rate is then used to compute the rate of return on rate base. MEPCO's rate of return on rate base may range from 13%-17%.

3.3.3.3. INTERNAL CONTROL

The PDIP team visited the largest regional warehouse site location and reviewed policies, procedures and operations. The MEPCO warehouse procurement policies are provided for under the Public Procurement Regulatory Authority (PPRA) manual. There are two distinctly different warehouse operations; one for 11 kV distribution system materials and the other for 132 kV transmission materials. The 11 kV warehouse operations consist of four regional warehouses and 8 field warehouses. The MEPCO Annual Financial Audit included no observations with regard to shortages in distribution and transmission stores.

It was noted that the value of obsolete and slow moving items accounted for approximately 2.5% of the total stores amount. While the Board of Directors has the authority to approve/write off amounts, action cannot be taken without PEPCO approval.

The Book of Financial Powers (BFP) is a governing document and was approved by the board of directors (Board) in October 2002. It establishes various approval authorities and monetary limits for financial

transactions and certain other actions taken by MEPCO management and Board in the operations of day-to-day activities. The Book needs to be reviewed and updated with new amount thresholds and approval authorities consistent with maintaining high corporate governance and internal control standards. Any changes to the BFP currently require approval by PEPCO.

In a review of the Internal Audit (IA) Department, it was determined that the IA operation employs approximately 134 people out of a total 140 sanctioned posts. IA continues to employ the WAPDA Audit Manual dated August 1985. In addition to the WAPDA manual, IA uses a Revenue Audit Manual issued by WAPDA in June 1998 to replace Chapter 1 and Chapter 6 of the Audit Manual. This manual was designed to assist in the review and certification of consumer electricity billings, and to report to Management the status of compliance of policies/procedures regarding commercial operations. The functions of the IA Division, as defined in the Audit Manual under section 2.1 are: "to insure that rules and orders framed/adopted by the Authority from time to time in connection with execution of works, pay and allowances, stores etc. and for maintenance of various accounts, books, etc. are followed by all WAPDA formations/offices, and the defects and irregularities noticed in such accounts/books rectified as far as possible". At present, the Internal Audit Unit functions only as a limited reviewer of certain transaction based activities. It. focuses only on effecting specific transactions rather than on full reviews of internal control systems. The department is routinely asked by affected departments to correct . IA-identified problems.. The PDIP team agrees that any problems discovered during the IA process should be corrected by the department under the authority and direction of the Department Head. Also, the IA reports directly to the CEO with no linkage to the BOD. The existing Audit Manual does not address the specific audit procedures required to perform internal auditing procedures in an ERP environment.

The team is concerned by the lack of professional expertise in the IA unit with only 4-5 professionally qualified employees out of a total of 134. The IA Manager expressed a real need for training and capacity building to enable the department to function effectively.

3.3.3.4. COST CONTAINMENT

Cost containment refers to the process of identifying expense items and categories that offer opportunities for significant savings through identification of alternative sources for goods and services. The DISCOs have historically been required to employ WAPDA facilities for software and other services that are not cost competitive with private sector sources. The application of WAPDA requirements is not uniform across all DISCOs, so opportunities for savings may vary from one to another.

In the case of MEPCO, vehicle fleet maintenance costs were discussed with the Manager of Transport. The MEPCO vehicle fleet consists of a total of 964 vehicles; of which 433 are under 10 years old, 290 between 10 to 20 years old, and 241 over 20 years old. Minor vehicle repairs are done through MEPCO's internal repair operation, while major repairs are competitively bid. MEPCO has no formal vehicle replacement policy based on either the age or number of miles on the vehicle. However, the Manager of Transport did give an example where a cost/benefit analysis was done on the cost of repairs to support the purchase of a new vehicle but because there was a ban on the purchase of new vehicles nothing was done. Currently there is a ban on the purchase of new vehicles established by PEPCO and which MEPCO is following.

Currently MEPCO is paying RS 21.92 million to PEPCO for three software application packages which, if converted to an ERP solution, can eliminate this expense.

MEPCO has significant vulnerability owing to lack of insurance on its facilities. Grid stations and certain new vehicles are the only facilities covered.

3.3.3.5. FINANCIAL REPORTING

MEPCO is in urgent need of an ERP solution. It has over 4 million consumers, approximately twice the size of the average of all other DISCOs, with divisions of over 200,000 consumers, and serves the largest service territories after QESCO. Manual systems are still the primary form of processing and reporting. The team interviewed one divisional revenue office manager who stated they handle approximately 150 consumer

inquiries per day, requiring special requests to the IT Department for consumer billing, consumption, and other information in order to respond.

During the team's interview with the IT unit, we were informed that no progress has yet been made vis a vis planning/implementation of an ERP system. PEPCO apparently plans to manage the ERP implementation process by following the template used for LESCO, and MEPCO's IT Dept. is thus awaiting PEPCO approval/action

The PDIP team is concerned by the lack of initiative, foresight and planning prevailing in the IT Department regarding MEPCO's organizational system solutions. Additional oversight will be required, as well as ownership of future programs by IT units to equip the utility with the systems necessary to render it a robust, highly functioning electric distribution company.

An ERP solution will be paramount for MEPCO in its migration to from a manual to a computerized system for its financial, materials management, human resource, and customer information/billing systems. The most common ERP system observed by the team has been an Oracle based system (implemented at LESCO) with the following applications:

Financials

1. General ledger
2. Receivables
3. Payables
4. Asset management
5. Cash management
6. Project costing
7. Business intelligence

Materials Management

1. Purchasing
2. Inventory management
3. Order management

Human Resource Management

1. Core human resource data base functions
2. Payroll
3. Self service
4. Recruitment
5. Expense management

An effective ERP implementation will lead to the following benefits:

1. Better control at all levels.
2. Ability to facilitate day-to-day management reporting.
3. Provide immediate access to enterprise information.

4. Integrate various business functions.
5. Produce more accurate information.
6. Improve financial management and corporate governance.

All DISCOs were required to convert to the NEPRA Uniform System of Accounts by December 31, 2010. The new chart of accounts will be more detailed than MEPCO's current chart of accounts. The company met the December 31, 2010 deadline; and should now provide additional management reporting detail.

MEPCO continues to use a legacy WAPDA Accounting Manual that has become increasingly outdated due to changes in accounting practices in Pakistan. The MEPCO Finance Director is in the process of updating this manual.

3.3.3.6. FINANCIAL PERFORMANCE INDICATORS

Financial performance indicators provide a means of measuring distribution utility performance as a function of other, similar high-functioning electric distribution utilities. Use of performance benchmarks requires establishing a reasonable baseline for comparison – that is, finding a group of electric utilities that are of similar size and characteristics (geographic scope, gross sales, sales density etc.). While the DISCO community in Pakistan provides a reasonable peer group for comparison between one another, it would take more time than is available to identify an ideal group of high-performing electric utilities that are quite similar across many characteristics.

For purposes of comparison, PDIP proposes to use financial and technical performance characteristics of the large group of rural electric utilities in the United States. These utilities are small in comparison to the Pakistan DISCOs; have far fewer consumers per kilometer of distribution line; but are characterized by low line losses and extremely high collection rates, and have been financially self-sustaining without capital or operating subsidies. For purposes of this comparison, the largest of the US rural electric distribution cooperatives were selected for this benchmarking process. These cooperatives range in size from slightly more than 80,000 consumers to over 200,000 consumers; DISCO sizes range from 400,000 to over 4 million consumers.

The current ratio is an indication of an entity's ability to pay its current debts. Generally, a ratio below 1.0 means an entity may have problems in meeting these obligations. MEPCO's current ratio of .71 needs periodic monitoring should its financial position worsen.

Maintenance expense as a percentage of operating revenue indicates that MEPCO is spending significantly less at 1.07%, than are the US cooperatives at 7.98%, to maintain its electric system.. However, this is partly explained by the fact that the higher sales density MEPCO requires a smaller investment in total utility plant per kilometer of line than have the US cooperatives. The plant revenue ratio (total utility plant/operating revenue less cost of power) indicates MEPCO has significantly less operating revenue remaining after power costs to support its existing plant through operations and maintenance expense - 32.5, when compared to the US cooperatives - 6.3. The US cooperatives have invested significantly more in total plant per kilometer of line - Rs.2,622,327, than has MEPCO - Rs. 901,435.

Given the very low consumer density per kilometer of line, the level of line losses for the US cooperatives (5 %) should present a reasonable target for overall technical losses for DISCOs. Line loss in excess of 5% could therefore be viewed as non-technical losses, and an opportunity for operational improvement.

The amount of trade debt receivables over 60 days as a percentage of operating revenue is favorably comparable for MEPCO - .57%, versus the US cooperatives - 0.23%. : MEPCOs trade debt to operating revenue ratio is, while the US electric cooperative average is. This comparison is based upon FY 2010 MEPCO trade debt.

US electric cooperative consumer density averages 8 consumers per kilometer, while MEPCO has 63 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1,

while MEPCO's consumer to employee ratio is 251 to 1. Even though MEPCO is the highest in consumers per employee when compared to other DISCOs (see Table 17 below), it could improve its financial position significantly by steadily working to improve the consumer to employee ratio close to the US rural electric cooperative average. Were MEPCO able to achieve a consumer to employee ratio close to the US average, its savings would approach Rs.1.5 billion per year.

MEPCO's negative equity and current year net income has resulted in a negative return on assets (6.13)%, equity as a % of total assets (24.7)%, and long term debt as a % of total capitalization (5.8)%.

Category/Performance Indicator	MEPCO	US Cooperative Ave.
Liquidity		
Current Ratio	.71	1.6
Amt. over 60 days/Oper. Rev (%)	.57	0.23
Profitability		
Return on Assets (%)	(6.13%)	5.07%
Op. Rev./km line (Rs.)	1,368,552	1,528,519
Consumers/km line	63	8
Consumers/Employee	251	467
Main Exp./Op. Rev. (%)	1.07%	7.98%
Op. Exp./Op. Rev. (%)	6.33%	7.03%
Cost of Power/Op. Rev. (%)	97.52%	70.55%
Plant Utilization		
PRR (one year Plant Rev. Ratio)	32.5	6.3
Total Plant/km line	901,435	2,622,327
Solvency		
Equity/Assets (%)	(24.7%)	42.4%
Long term Debt/Ttl. Capitalization (%)	(5.8%)	52.0%
Line loss (%)	19.3%	5.0%
Elec. sales Collected/Elec. Sales billed (%)	74.2%	N/A
Government	52.9%	N/A
Non-government	84.9%	N/A

Table 17: MEPCO/US cooperative performance ratio comparison.

3.4. COMMERCIAL MANAGEMENT

3.4.1. OVERVIEW

This chapter describes MEPCO commercial management practices, followed by an analysis of the impact of selected changes to these practices. The policies, practices and procedures employed by MEPCO are not unique to it; they are in general common to all Pakistani DISCOs, varying in scale and in some particulars.

3.4.2. SUMMARY OF KEY FINDINGS

The following are key findings of the PDIP review of MEPCO's commercial management.

- **New service connections—** Several measures designed to minimize mistakes in the data entry into the CIS unfortunately contribute to significant delays in consumer billing – sometimes for several billing cycles. As a result, some newly connected consumers have received service for more than a year before receiving their first bill. MEPCO, on the average, is connecting 15,000 customers each month.
- **Meter reading—** Numerous problems were found in the area of meter reading. Commercial management and employees indicate that there is insufficient time to perform the randomized evaluations of meter reading accuracy that are supposed to occur. Due to the rapid increase in customer numbers, many meters are not read each month. Moreover, review of meter reader logs revealed that meter readers do not consistently identify and record problems with meters. Further, MEPCO does not employ a practice to remove, clean, and calibrate meters.

- **Bill preparation—** The billing process involves manual data transfers and data entry, which often cause delays. The billing program developed in the late 1960s is designed around batch processing, so if one reader is behind schedule, the entire batch is delayed. The large geographical service area and the inability to disperse data entry impede the billing process. Reading errors that cannot be resolved by the computer center are frequently accepted as is by the revenue office.

  Bill delivery—Inadequate time is allowed for bill delivery with the result that there are instances where bills have been delivered on or even after the payment due date. Delays in meter reading and bill processing result in delays of bill delivery. MEPCO has experimented with contracting bill delivery with mixed results. Delivery of bills is often by hand, so lack of transportation also routinely delays bill receipt/payment. Bills are hand-delivered to customers in urban area; frequently that are left at a single location in rural areas. MEPCO has piloted outsourcing bill delivery in 14 subdivisions.

- **Bill adjustments—**Adjustments to consumer bills can be made at any center, but the bill must be returned to consumer's revenue office for data entry. Since there may be a substantial time lag in processing the adjustment, the consumer may have to return to the billing center for another billing adjustment. In simple terms, the company's back-office procedures do not follow through with actually adjusting the consumer records. Due to processing methods, bill adjustments may not appear on the bill; the arrears balance is adjusted instead.

- **Payments—** The payment handling arrangement is also fraught with inefficiencies and requires frequent, manual intervention. For pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. Payments received by banks situated in a data center outside the customer's geographical area are processed and placed in an unidentified cash account; many are cleared only when the customer complains. Banks do not accept payment amounts less than those indicated on the printed bill. Lack full payment by customers has increased the arrears by 2.2 billion Rs since June 30.

- **Disconnection/reconnection—**While MEPCO's process for disconnecting/reconnecting delinquent customers is reasonable, it involves a number of separate departments and is not automated, introducing potential risks and delays. The increasing number of outstanding EROs – 20,826 at November 39 as compared to October's balance of 14,228 and 2,482 at June 30, indicates that procedures/policies are not being followed. Rather than paying arrears, some customers may obtain a new connection.
- **Customer service**— Customer service is primarily complaint resolution. Service centers can issue duplicate bills, installments, and extensions. Operations personnel at the local levels receive the complaints at the field offices. Most complaints received are excessive billing. At the local levels, there are no dedicated customer service representatives.

- **Meter maintenance—**Meter inspection, testing, repair and replacement are inconsistent at best. Established procedures are not followed, documentation is not completed, and handling of meters appears haphazard. Defective meters are left in service for several months. Management of meter assets would be much better served by enforcing existing guidelines.

- **Theft control—**Theft of electricity and related fraudulent activity that reduces revenue to MEPCO is rampant and varied in its manifestations. Many instances appear to involve company employees. Reconciliation of customer meter readings to known area meter readings, which would highlight areas for investigation, has not been implemented.

- **Meter integrity and meter reading practices—**When a meter is declared to be defective, the consumer is billed on the average consumption of the last 11 months. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer. Since it takes 3-4 months for the meter to be replaced, the air conditioning season is over before the consumer is billed on actual consumption again. Also, with many meters located 7-10 feet above ground, it is difficult to detect meter tampering.

- **Information technology**—Presently, MEPCO business processes are characterized by manual and cumbersome practices, inadequate controls, insufficient commercial focus, limited transparency and lack of reliable information. The use of information technology to improve efficiency and effectiveness has not yet proven successful. Several standalone applications are not integrated either with other applications or with potential applications to be deployed in the future. Although the level of deployment of IT varies significantly from one DISCO to another, the key applications have been in multilevel aggregation of data or in large-scale data processing. In other words, IT is being used as a tool to address a specific issue or two at a time and not as a long-term, holistic strategy to achieve fundamental business goals. MEPCO's move to an ERP environment is an opportunity to rationalize and update core business processes as a prerequisite to further automation.

3.4.3. ANALYSIS & DISCUSSION

The revenue cycle in the DISCOs, including MEPCO, is governed by three documents, comprising:

1. Commercial Procedures, 6th edition-November 2000, plus Amendments which have not been codified;

2. Consumer Eligibility Criteria 2003; and

3. Consumer Service Manual 2010.

The Commercial Procedures Manual is a true procedures manual developed by USAID in the 1980s and is still the primary document for carrying out commercial activities. Revisions that have been made primarily raise authorization limits and reassign signing authority as needed.

In response to the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the Act), NEPRA developed the Consumer Eligibility Criteria Manual in 2003, to ensure a non-discriminatory provision of distribution service and sale of electric power to all consumers within the service territory of a distribution company. This document is included as an Appendix to the Consumer Service Manual.

The Act also led NEPRA to prepare the Consumer Service Manual that provides instructions and a code of conduct/procedures for dealing with the consumer. The manual describes the obligations and rights of the consumer, as well as the rights and obligations of the DISCO. The timeframes for processing consumer applications, completing service connections, meter reading, bill processing/delivery, and resolving complaints are all addressed in this document. It also includes safety and conservation tips for the consumer. The frequent clause "(DISCO to insert its name)" implies that all DISCOs are to follow the policies stated and not develop their own.

3.4.3.1. OVERVIEW OF REVENUE CYCLE

The revenue cycle is composed of a number of interrelated steps. The first step – perhaps a pre-revenue prerequisite, is the application for service connection. There are non-recurring fees assessed in the application and connection process, so this is in fact a part of the revenue cycle process. Once a consumer has received a service connection and begins consuming electricity, the DISCO revenue system must collect consumption data, process the data, print and deliver the bill, and collect revenues from the consumer. Each step requires a structured set of actions that must be orchestrated to allow the DISCO to manage an extremely high volume of transactions on a monthly basis. The following sections of this report describe each step of the revenue cycle for MEPCO; much of this information applies to all DISCOs, since they use very similar commercial practices.

3.4.3.2. NEW CONNECTIONS

The first step in revenue cycle management is to register and connect the consumer. The location associated with the meter is identified as the consumer; that is the premise is assigned a billing account number. Should the occupant of the premise change, the billing account number does not follow the consumer, and the name associated with the number is changed. Numbers are assigned in the walk order of the meter route. As new structures are added, the route must be renumbered to adjust to the additional locations, and consumers are assigned a new billing account number.

MEPCO's new connection policy is similar for general and industrial consumers. The difference is in the documentation required and in who has the authority to approve the application. General consumers (domestic and commercial) can apply for service at the local subdivision office. Large consumers must apply at the marketing and tariff office located at the headquarters complex. Once the application and terms of agreement are completed, signed and appropriate documentation attached, the application is assigned a registration number.

Within a week of receiving a consumer application, the subdivision will conduct a site survey to determine if there is available power, and prepare the cost estimate for the connection. General consumers within 40 meters of the connection point are charged a flat fee. A demand note for the connection fee and another demand note for the security deposit are prepared and sent to the consumer. The consumer has 30 days to pay the demand notes at the pay point specified. Once payment has been made and the subdivision office notified, the consumer is added to the queue for new connections. New connection efficiency is measured by the length of time from payment of the demand notes until the consumer is connected and billed.

A service connection order (SCO) is prepared after the fees are paid. The meter, cable, and necessary materials are drawn from stores, and the connection installed. Unfortunately, the materials needed are often not available for several months after payment of the demand note. There is no communication between stores and the personnel preparing demand notes. Inventory has a computer system, but it is not integrated with any other system. The consumer will still pay his note in order to get onto the priority list for installation. Management reports that there is pressure to expedite certain customers. When the consumer

finally gets connected, the completed SCO is sent to the revenue office to enter the consumer into the billing system.

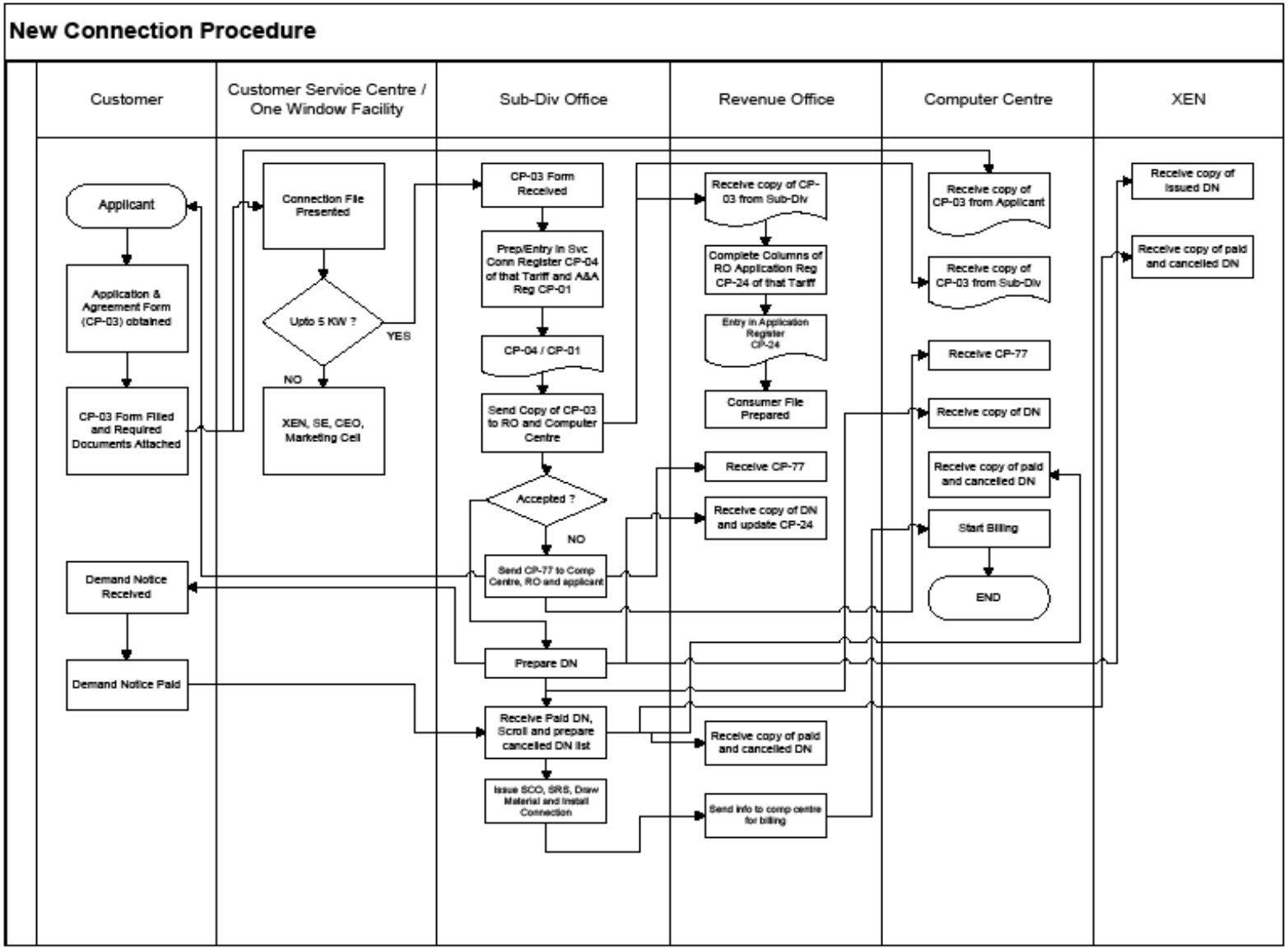
MEPCO follows the prescribed process to some degree. The target is to have new connections installed 35-45 days after the registration of the application. MEPCO can connect an urban customer within 15 days of application if they can locate the house, the customer pays immediately, and material is available. The target does not take into account any delay of payment by the consumer, or the shortage of material in the warehouse. At the end of November 2010, 32,000 ripe connections were pending, the majority for under 3 months. For the period ending November 2010 MEPCO connected an average of nearly 15,000 customers each month.

Several factors designed to minimize mistakes in data entry into the CIS unfortunately result in significant delays in consumer billing – sometimes for several billing cycles. For example, the transfer of documentation needed to include the new consumer in the billing system is a low priority for the technical personnel, and is usually done once a month. In extreme cases, newly connected consumers have received service for more than a year before receiving the first bill. Even if the completed SCO is transferred immediately, it may still take MEPCO two months to process the first bill.

The delay in billing the consumer is the result of the process. The process is as follows: the revenue office prepares an input sheet of customer data; this information is sent in electronic format to the billing center; the billing center then prints a posted list showing new connection details and sends it to the revenue office; the revenue office will verify the data as correct. If the data is not correct, the errors are corrected, sent back to the billing center, and the posted list printed again. Once the data is verified and accepted as correct, the first billing cycle may have passed. Because the meter reading list is prepared days in advance, the new consumer may have missed the first billing cycle by a matter of a few days. Fig 2.1 illustrates the new connection procedures.

To minimize the delays, MEPCO has piloted in 5 subdivisions a computerization of the of the new connection process. The actual procedures have not been changed, but the record keeping process is being streamlined. It is no longer necessary to transfer the same data multiple times. There are however problems with the data collection as the computer data did not reconcile with the manual system.

Figure 1: New Connection Process



3.4.3.3. METER READING

Effective, efficient, and reliable metering and recording of electric power consumption is the heart of the electric power distribution utility commercial system. Many utilities experience significant difficulties in the meter reading process, including inaccurate or faulty meters; human error in recording and/or transcribing meter reading data; delays in recording and transferring metering data; and meter reading fraud involving consumers, meter reading employees, and third parties.

There are a variety of strategies that can be employed to address problems with meter reading, including auditing meter readings; rotation of meter reading employees; outsourcing meter reading services; & use of advanced metering technology including automated meter reading and/or use of pre-paid meters. Each option and technology comes with an associated cost and vulnerability; no single approach is fool-proof, although some are less problematic than others.

MEPCO and its DISCO counterparts have designed checks and balances in the meter reading policies and procedures in an effort to ensure robust and trustworthy metered data from MEPCO consumers. Unfortunately, this is the area of commercial operations for which there is a highest degree of distrust and anecdotal information regarding employee manipulation. It is important to note that the purpose of this report is not to present evidence of fraudulent practices, or to make unsubstantiated claims; but to identify problems that affect DISCO performance, and propose solutions for them.

The Commercial Procedures Manual requires routine verification of meter readings and bill deliveries as shown in Table 18 below.

Percentage of meters/consumers to audit							
Responsible Officer	General	Industrial > 40KW	Industrial < 40KW	Tubewells > 40KW	Tubewells < 40KW	Load > 500KW	Unspecified
Line Superintendent in charge	5%	15%		15%			
Meter Reading Section Supervisor	20 per week	15%		15%			
Subdivision Officer	5 meters per day	2%		2%			
Executive Engineer			10%		10%		2 meters per day
Superintending Engineer						15%	1 SDO audited meter, 1 XEN audited meter, and 3 meters

Table 18: Meter auditing/verification responsibilities

While these measures have been included in the MEPCO system, interviews with utility commercial staff and record sampling indicate there is little or no evidence that these procedures are actually followed. Division staff interviewed stated that a limited number of the readings were reviewed each month (less than 1%). MEPCO commercial management and employees indicate there is insufficient time to perform the randomized evaluations of meter reading accuracy; and review of meter reader event logs revealed that meter readers are not consistently identifying problems with meters.

Figure 2.2 below illustrates the meter reading, data processing, and billing processes as described by MEPCO commercial staff, and verified by the PDIP team. As the diagram shows, the meter readers are responsible for meter inspection: to note problems with the meter enclosure, signs of meter tampering, meter stoppage,

or other problems. The diagram also shows that the Sub Division Officer is also responsible for performing random checks of meter reading values – to verify if there are issues with particular meter readers. Thus, there are formal checks in place to detect meter inaccuracy, as well as to detect meter reading fraud.

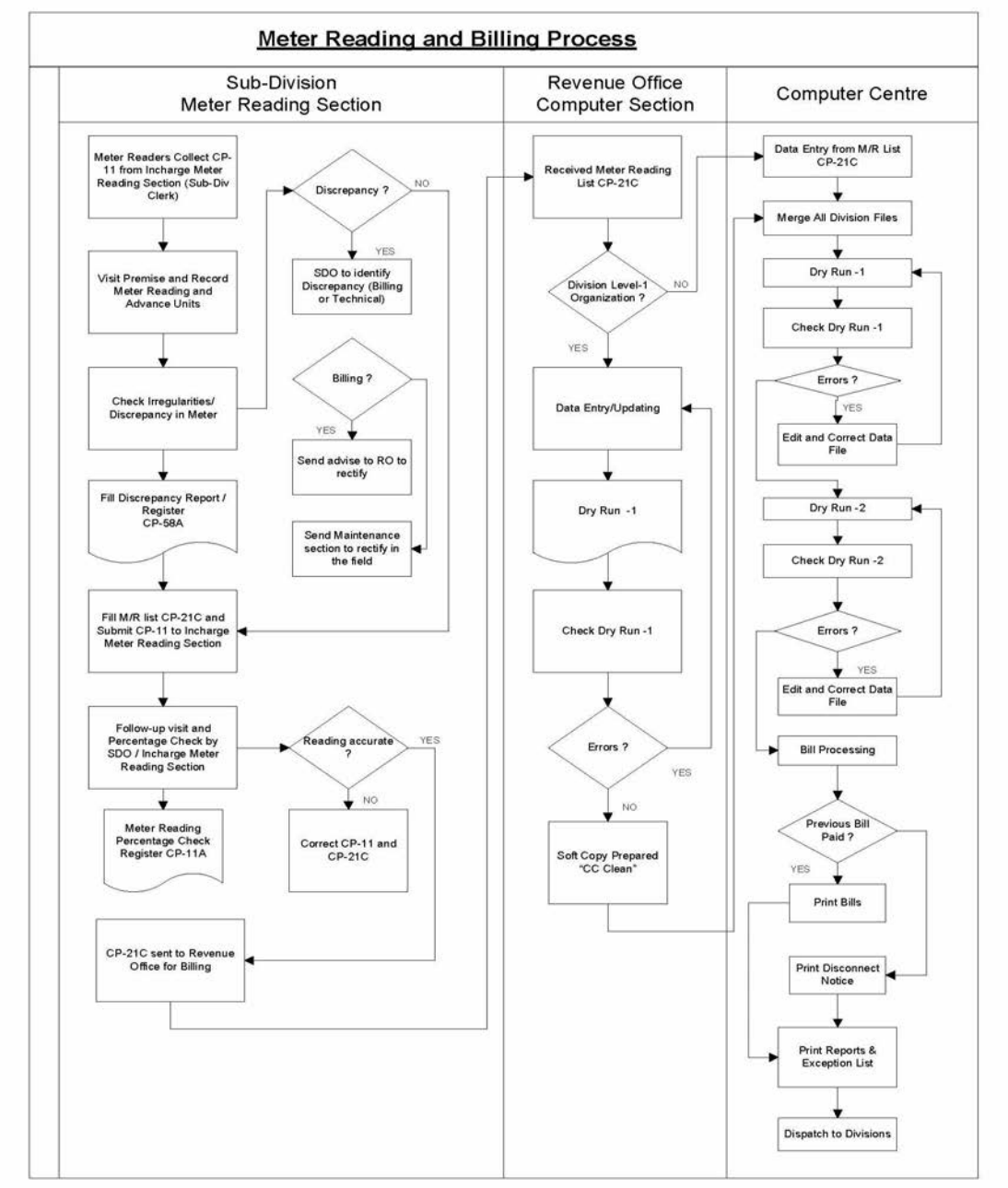


Figure 2 Meter reading and billing cycle (general consumers) process diagram

MEPCO designs meter reading into a series of batches. Given that there are 23-25 working days per month, it divides consumers into 25 batches for purposes of meter reading, bill printing and delivery. This allows for continuous bill processing. The benchmark is for the bill to be given to the customer within 10 days after the meter reading.

MEPCO uses 20 batches to manage the meter reading and billing cycle for general consumers. These batches are read by the regular meter readers. The additional batches are primarily for industrial, tubewell and other consumers equipped with demand and/or time of use meters that are read by the subdivision officer or the division executive engineer. These batches also contain domestic and commercial consumers.

The reading list for each batch is supposed to include consumers on the same feeder. However, this is not always the case. MEPCO commercial officers stated that exceptions are made where feeders intersect; it is more convenient for the reader to read the meters on adjacent feeders when they are already in close proximity to them. Readers read approximately 100-150 meters per day. However, because MEPCO has been adding a significant number of new consumers (over 15,000 each month), the batch size is the total of general consumers divided by 23-25 working days. The batch is then divided by the number of readers to create the daily route size; many meters may not be read every month. Some areas are so large that meters are read in clockwise direction one month and anticlockwise the next.

The billing center has the target of delivering meter reading lists to the revenue office 8-10 days prior to the scheduled meter reading date. Thus the reading lists may be prepared 10 days or more before scheduled reading dates. These lists are delivered to the division office and then distributed to the subdivision offices. They may reach the meter readers 3-5 days after the reading date. However, the readers do not use the reading list while reading meters. Readings are recorded in a "Kalamzu (meter reading) book" and then transferred to the reading list at the end of the day.

The reading lists contain the consumer's number, tariff code, status code, the previous reading and consumption for the same month in the previous year. When transferring the current reading from the Kalamzu book to the meter reading list, the reader also calculates the consumption. If this is out of line with the previous year's consumption, the current reading may be adjusted. It was not uncommon to find cross outs and overwrites on the reading list. The purpose of calculating consumption is to prepare a check for the data entry of the readings. The process of meter reading and preparing the meter list may take 2-3 days.

The date of the meter reading used for billing purposes is the date scheduled for the meter reading. Readings may actually occur 2-3 days before to 2-3 days after this scheduled date. The team had reports of readings being intentionally delayed to improve loss calculations.

3.4.3.4. BILL PREPARATION

The meter reading lists from each subdivision are passed to the division's revenue office. The transfer process usually requires another day or so. There are no Level 1 offices in MEPCO, so all data entry is done at the Computer Center. The revenue office will check the readings for obvious errors, and then transfer the lists to the center, which enters the readings and consumption for all circles under its control.

As noted above the consumption data serves as a check for data entry; ; the manually calculated consumption is entered along with the meter reading; since warnings are issued if the consumption entered does not equal the consumption calculated by the computer. Exception lists noting missing readings, or differences between computer calculated & and data entry consumption, are created. All errors that cannot be resolved by IT personnel are returned to the revenue office for verification. In the interest of time, the revenue office frequently accepts the meter reading as is.

If closing for the previous month has not been completed, bill processing will be delayed. If all batches with the same number have not been received from all circles served by the center, bill processing may also be delayed. Until the batch for each division has been entered and verified, files cannot be merged or bills processed. If one division is behind schedule, the entire batch is delayed.

The issue date on the bill is not always the date when the bill is printed. However, the due date on the bill is calculated from the issue date—normally 10 days from the issue date for general consumers. MDI batches have a scheduled due date 14 days after the issue date. The schedule allows only 1 day from the issue date for delivery to the revenue office and to the consumer. If the bills are not issued on time, the consumer does not have the required 7 days between receipt of the bill and payment due date.

The billing program that is being used by MEPCO was written in COBOL in the late 1960's. Since the code was originally written, revisions have been introduced to improve functionality for maintaining customer balances. Printing of bills and reports is done in SQL. The database is designed exclusively for electricity billing activity.

The billing program was first developed by WAPDA, which originally programmed controls to ensure the integrity of the program and the data it contained. This program is now run by the DISCOs and many of its controls no longer in use. There has not been a transactional audit since the transfer. The DISCOs may decline program updates. This has caused bills to be incorrectly calculated.

There are 25 billing centers distributed throughout the eight DISCOs. A DISCO may have 1 to 5 centers; MEPCO has 5 -- 1 main center and 4 sub-offices. As earlier indicated there are great distances between some centers and the divisions they service. This delays processing and transferring printed bills in a timely manner. Customer Service Centers are connected to the system via the web so that duplicate bills can be produced. These customer service offices have no access to customer history, merely to the current bill.

The MEPCO bill format requires modification. The current version makes it difficult for the consumer to determine if adjustments for previous months have been posted to his account, how the FPA adjustment was calculated, how the arrears (past due balance)were determined, or the amount on which taxes are calculated defined. Late penalty fees are calculated on select items of the current charges, and not on the total amount. For transparency, the bill should begin with the previous month's balance, show all transactions for the current period, and then the balance now due.

3.4.3.5. BILL DELIVERY

The due date should be calculated from the bill print date with an adequate allowance for delivery. The consumer should have at least 7 days from receipt of the bill to complete payment to MEPCO. However, the due date is usually the target date prescribed by standard MEPCO revenue practices, without taking into account that frequent delays occur. As a result, inadequate time is allowed for bill delivery; there are cases wherein bills have been delivered on or even after the due date.

Normally DISCO personnel are responsible for bill delivery, but MEPCO has piloted outsourcing the delivery process in 14 subdivisions during the past year in an attempt to get the bills delivered on time. Normally, the contracted deliverers obtain a signature as proof of delivery. In addition to delivering the bills, the contract personnel are to check at disconnected premises to determine if another power supply has been obtained or if there are mistakes in tariff. In other subdivisions, employees hand bills to urban consumers. The pilot has mixed reviews. Some areas have shown an improvement in delivery, other areas had little or no improvement. Because transportation is not provided, the bills for the rural areas are left at a single location (usually a Mosque or a corner utility store), and the consumers are responsible for collecting them. This introduces another source of risk to the bill delivery process.

Consumers have the option of having their electricity bills emailed to them. They may sign up for emailed bills on the MEPCO website, or even get their duplicate bills printed through the MEPCO website.

3.4.3.6. BILL ADJUSTMENTS

Bills can be adjusted if required at the Customer Service Centers. When bill delivery is not timely consumers can request an extension of up to 3 days. If a consumer makes a request for partial payment of a bill, the CSR may authorize installments of three payments, provided the total amount is less than Rs. 10,000.

Adjustments to consumer bills can be made at any center, but these must be returned to consumers' revenue offices for further processing. The problem that may arise is the time required to deliver the adjustment to the consumer's revenue office, and the time the adjustment is actually entered into the computer. The data entry input form for the adjustment is sent to the Computer Center in the same batch that contains the meter readings for the month. If there is a substantial time lag, the consumer may have to return to the billing

center for another billing adjustment. In other words, the back office procedures do not follow through with actually adjusting the consumer records.

Consumer accounts are updated twice a month—at the time of bill processing and at the month end . An adjustment made after bill processing but before month-end closing will never appear on the bill. The closing balance is adjusted, so the adjustment appears as an outstanding balance on the next bill. Normally, the adjustment appears as a current month transaction.

Adjustments for consumptions are calculated by the computer. The computer only stores the last three tariffs. If the adjustment is for a period prior to the last stored tariff, it is calculated using the oldest tariff. This adjustment also affects the previous reading, destroying the trail of readings from one bill to the next.

3.4.3.7. PAYMENTS

Payments to MEPCO can be made at any banks that have teller arrangements with MEPCO, at local post offices, at NADRA kiosks, or electronically. It has been reported that more than 50% of funds are received electronically through NADRA and online banks.

Customers can make payment at any pay point. Each pay point transfers payment information to a specific revenue office. If payment is received by a bank situated in a data center outside the concerned geographical area, the amounts are listed as unidentified. Manual intervention is necessary to transfer the payment data to the proper customer. Other unidentified amounts arise when the account number is incorrectly coded. Many unidentified amounts are cleared only when the customer complains he/she was not credited for the payment.

As payments are received, the pay points prepare a scroll documenting the customer account and the amount paid. If the banks have online facilities the customer information may be transferred electronically. Scrolls and payment stubs are physically transferred to the revenue office. The revenue office reconciles the number of stubs and scroll entries; this process usually takes two business days. If the bank forwards the scrolls and the payment stubs daily, it takes four days from the date the consumer makes his payment until it is received by the computer center. Personnel at the computer center will scan the payment stubs and reconcile the amounts to the scrolls.

Pay points will not accept payment amounts less than the amount indicated on the printed bill. If the bill has been adjusted by the utility, the billed amount is adjusted, with the adjustment written on the bill. However since bills are bar coded, adjustments require manual intervention when scanning the stub for data entry. The actual due date is included in the bar code. While scanning at receipt, the computer will adjust the amount billed for the late penalty. If this does not agree with scroll, the scroll amount takes precedence.

The money, net of collection fees, is usually transferred to MEPCO's collection account daily. The timing of fund transfer is dependent upon the agreement between the utility and the pay points. MEPCO closely tracks the receipts of scrolls and funds. If not received as per the agreement, a letter is sent to the bank manager inquiring why the remittances were not timely received.

Daily postings to the consumer accounts are balanced with the bank scrolls (receipt logs) by the data entry personnel. Banks provide a weekly statement of amounts collected. The revenue office of the division will reconcile the statement with the office copies of the bank scroll transmittal documents.

The progressive collection rate as of the end of November, 2010 was 94.5%. Private customers paid 96.2% of the total assessments for the period while the government had only paid 68.7%. The net arrears at the end of November totaled 9.8 billion Rs and increase of 2.2 Billion Rs since June 30.

3.4.3.8. DISCONNECTION/RECONNECTION

The billing/collection program automatically prepares a list of delinquent consumers subject to disconnection through an Equipment Removal Order (ERO). The list is reviewed and edited by the billing supervisor and

the revenue officer. The latter has the authority to selectively delete consumers from the list, and those EROs are cancelled. The actual disconnect list is manually prepared because of the time lag between computer preparation and adjustments for payments received.

The list, equipment removal orders and cancelled orders are sent to the revenue officer. The orders are sent to the technical department for execution. On a periodic basis, the revenue officer is required to review the status of equipment orders to ensure that delinquent customers have been disconnected. When such orders are executed, MEPCO technicians remove meters and services from the customer's premise, to be deposited and stored in the subdivision warehouse.

If the consumer pays all amounts due within one year, the service and meter are reinstalled. After one year the equipment is returned to division stores. Should the consumer pay his bill after one year but before three years, he/she may be reconnected, but is required to pay for a new service connection. The consumer is credited with the depreciated value of the equipment removed, but must pay for a new service and meter. After three years, the consumer is required to pay the current security deposit and the full equipment costs.

The delay in executing disconnection orders is increasing the defaulted receivables. At the end of November 2010, 20,846 EROs were pending as compared to 14,228 at the end of October2010; and 2,482 at the end of the previous fiscal year. It is not uncommon for consumers to obtain a new connection before the disconnection of the existing connection. The new connection has a new account number. The old connection goes into default and is disconnected. After a specified period the security deposit is applied against the arrears of the old account which is transferred to the dead defaulter batch by the utility.

3.4.3.9. CUSTOMER SERVICE

As with most DISCOs, MEPCO's customer service is primarily complaint resolution. Consumers may lodge complaints at any of the Customer Service Centers located at the circle and subdivision offices, or at the complaint offices established in subdivisions. There is also a center located in the headquarters complex to handle complaints filed over the internet or forwarded from WAPDA and other agencies, in addition to walk-ins. The regional centers are open only during office hours, but the subdivisions have 24/7 availability for service complaints; bill complaints are taken only during office hours. Many complaints are taken directly by the SDOs and XENs since their numbers are listed on the bills.

In an effort to improve its image, MEPCO HQ Officers are to sit at the Regional Complaint Centre for two hours a week (a different officer each weekday) to handle complaints regarding electricity. "They will issue orders on the spot where possible for immediate disposal of complaints… In case of non availability of any of the officers, the next officer will sit in his place."

Complaints are manually registered in log books according to type of complaint. Most bill complaints were for erroneous readings and non-delivery of bills. There were 21,770 bill complaints for the month of December 2010. Complaints regarding non-posting of payments can be solved by the revenue office or by the concerned bank if the customer has his receipt.

At the local levels, there are no dedicated customer service representatives. Complaints are handled by the SDO and XEN; windows may be manned by ALMs. If the complaint requires an adjustment to the customer's bill, the change is entered onto the bill and the customer is free to pay it. However, an adjustment form must be prepared and sent to the revenue office. This is prepared for data entry and batched with the meter list.

3.4.3.10. CONSUMER CENSUS

A consumer census was being conducted for just one circle. A check of the premise details (size, load, meter number etc.), customer information and contact number, and transformer connection was made. Although the survey was less than 50% complete, frequent findings included: wrong feeder codes, consumers billed but not metered, nonexistent registered consumers, and some premises with multiple connections. The survey was outsourced to BARBAAB, but many of the survey takers were former MEPCO employees.

3.4.3.11. COMMERCIAL DEPARTMENT ORGANIZATION

The MEPCO Chief Executive Officer (CEO) responds to the Board of Directors, and is responsible for representing the company in the greater Multan community. He manages all headquarters functions, and oversees field operations managed by Circle Superintendent Engineers (SEs). Divisions in turn are managed by Executive Engineers (XENs); and Subdivisions by Sub-Divisional Officers (SDOs).

The Customer Services Directorate is managed by the Customer Services Director (CSD) or Commercial Manager, who reports directly to the CEO; the Manager MIS reports functionally to the head of Customer Services Directorate, and administratively to the CEO.

The Deputy Commercial Manager (DCM) is posted at circle level and reports functionally to CEO, but administratively to the Superintendent Engineer (SE) of the circle. The Deputy Manager (MIS) is posted at the circle Computer Center and reports functionally to the DCM, but administratively to the SE of the circle.

The revenue officer posted in the revenue office at division level reports functionally to the circle DCM, but administratively reports to the division XEN .

The revenue office is organized into 4 main sections as follows:

- Accounts Section: headed by the Divisional Accountant, responsible for managing the cash book; its reconciliation with the weekly bank statement and with debtors' control accounts; and for accounting matters under procedures laid down in the Divisional Accounts Manual.
- General Section: headed by the Commercial Superintendent, responsible for receiving duplicate copies of specified application forms & other connection documents from the subdivision offices; and for maintaining connection application registers & files for each consumer.
- Billing Control Section: responsible for controlling meter reading and data delivery to the Computer Center; ensuring that billing is correct; making adjustments to inaccurate or incorrect bills; issuing disconnection notices; preparing certain management reports & statistics; bill dispatch.
- Debtors' Control Section: responsible for controlling the computer prepared debtors ledger; balancing ledgers; carrying out debt recovery action; maintaining debtors' control reports & statistics.

The following section summarizes a review of the value of prospective changes to MEPCO's commercial practices.

3.4.3.12. ANALYSIS OF CHANGES IN REVENUE CYCLE PRACTICES

Cash flow could increase with improved meter readings and if there was a more efficient mechanism matching new connections with an increase in customers. Consumers are not billed when the billing center fails to receive notice that a consumer has been connected or reconnected. In many cases, the consumer is billed after a period of delays, and the utility makes concessions by allowing installments or even forgiving a portion of the bill.

The revenue system could work more effectively if its practices and procedures were implemented with greater discipline. MEPCO performs routine inspections of subdivisions, noting workplace conditions, procedural compliance, and various statistics. There is no standard report format or practice of corrective actions. Many of the registers were not produced or noted as incomplete. There have been complaints that work cannot be done because the staff is too busy filling out the registers.

However it is the undocumented transactions (aka administrative losses) that are alarming. The calculation of technical losses and energy accounting would allow a better reconciliation of deliveries and amounts billed. Comparing losses of the current period to prior periods is not an accounting of energy; it merely perpetuates the previous error.

Because there is such reliance on the meter reader in the revenue cycle, more rigorous controls and oversight are required of this reading cycle. It is impossible to assert effective transactional control if there is collusion between the meter reader and other parties in the revenue cycle. Although there are procedures in place that would provide some of the needed oversight, these are not adequately observed or performed in a timely manner. MEPCO does a few meter reading checks and compares the readings with those recorded in the Kalamzu books. However manipulation can occur while preparing the reading lists used for billing purposes. The preparation of meter reading lists can be eliminated altogether through a change in technology – or by a combination of changes such as automated meter reading with handheld devices.

Distribution losses may be hidden by adjusting (increasing) the consumption of selected meter readings. The addition of consumption to various consumers can be used to manipulate revenue and allow managers to meet performance targets, which are usually set as the total losses (technical and non technical losses) on individual feeders. The losses are calculated by comparing the number of units billed compared to the number of units delivered for each feeder. Over 10% of the feeders had negative losses for the month of November 2010. This indicates that excessive billing may be occurring in addition to timing differences in reading of delivery and revenue meters, inaccurate meters, and detection bills. The number of consumer complaints for erroneous readings also supports the theory of excessive billing.

Some of this manipulation may be uncovered during data entry. The computer produces many exceptions lists, such as consumption greater than normal for the consumer's characteristics, an aging of same-to-same readings, estimated readings, etc. Action is seldom taken. With the addition of automated meter reading, the data is uploaded to the billing program, eliminating the need to manually enter the data.

Meter lists and routes are not defined for individual feeders, which complicates energy accounting. Meter routes should be organized around metered transformers, and all those meters read on the same day. A reconciliation of energy needs to be made to for each transformer to determine the reasonableness of the energy billed. If it is not reasonable there may be theft, meters missed or recorded incorrectly, or a problem with the system.

To prevent newly connected/reconnected consumers going unbilled for several periods, logs of prepared service orders and status should be kept and reported. Service orders should be in duplicate, and copies sent to the revenue office who should be responsible for followup if the order has not been cleared within a reasonable time.

When the service connection order is prepared, the consumer should be established and entered into the meter reading list and the reader's Kalamzu book. The reader should track the progress of the installation while reading meters, and would be in the position to note the meter number and the current reading during the first cycle that the consumer is connected. The consumer's billing data can be pre-listed and he/she will be ready to be billed once the connection is completed.

If the customer can be given a reasonable level of service, he may not find it necessary to achieve his electricity through dubious means. MEPCO will have better control of its system, dangerous situations may be eliminated, and satisfied consumers shall be more likely to pay their bills regardless of the "outlandish" tariff rates.

3.4.3.13. METER MAINTENANCE

Meter surveillance is to be done by the metering and testing teams (M&T), but the primary responsibility for finding defective meters rests with the meter reader. Industrial meters are checked by an M&T team annually. The testing procedure is performed in the presence of the industrial consumer. Other meters will be tested if a consumer requests a test, if the utility employee reports an abnormality in consumption, or there appears to be physical damage. If the meter slows gradually with age, this will very likely go undetected. Moreover, many meters are located on poles or high on the outside walls of the premises, ie. above eye level. It is doubtful that those meters are actually read, and any damage or abnormality would go unnoticed.

Taking into consideration field observations of meter reader management, location of meters, and the state of many of the meters, it is doubtful that all meters are read and inspected each month. In theory, meter readers should inspect the meters during the reading process and report any abnormalities and damage to the meter each month. However, there was scant evidence of meter status reports in MEPCO revenue offices.

Meter replacement is done if the meter is reported defective. The meter discrepancy report/log of defective meters is updated by the meter reader; defective meter logs may not be kept in some subdivisions. The logs reviewed revealed that the entries are not numerous, and most were declared to be working by the line superintendent after the M&T team checked the meter. It may take several months to replace defective meters. At the end of November 2010, 9844 meters had been declared defective; 7584 were defective for 2 to 6 months, and 82 were defective for 7 to 12 months.

When a meter is reported defective it should be replaced immediately. If the utility had its own meter lab, it would be possible to fix it, recalibrate it, and place it back to stores to be reused. If it is not economical to repair the meter, it should be dismantled for spare parts that may be used in future repairs. This would increase the availability of meters for replacement.

Meter serial numbers are not routinely recorded when new meters are received from the manufacturer. Meters are "managed" at the subdivision level. When installed, the serial number is recorded in the Kalamzu book, and in the consumer's computer file. During the consumer census at MEPCO, one of the major findings was that meter numbers on record frequently did not match meter numbers in the field.

3.4.3.14. ADVANCED METERING

To improve the billing process, automated meter reading should be installed not only on the premises but also at delivery points. AMRs will eliminate transcription errors and reading errors; as well as manipulation of readings on behalf of consumers or management. The data can be loaded directly into the computer system. These meters result in real time consumption data provided directly to the utility's commercial system. Consumer usage can be monitored from a remote point of access (such as the commercial office). Because some areas are unsafe, a program to install AMRs is being implemented. Five AMR meters have already been installed on industrial loads. There is a plan to place static meters with GSM devices on 40 feeders as recommended by PEPCO and the World Bank.

Pre-payment meters may be used to allow consumers to purchase energy before using it. The basic principle of the prepayment system is that customers estimate how much energy they require before they consume it, and buy payment tokens (electronic or hard copy) beforehand from a vendor. The prepayment meter is then credited with the value of the purchased credit. After the prepaid credit has been consumed, the meter automatically disconnects until additional credit is purchased and programmed into it. While there are advantages to the consumer (no more over billing, control of the amount and timing of payment, ability to monitor consumption etc.), these advantages will have to be communicated to consumers to sell the program to them. There are obvious financial advantages for the utility. MEPCO personnel have however indicated unwillingness for prepaid metering installation fearing a loss of control of theft due to technical issues.

3.4.3.15. METER READING AND BILL DELIVERY PRACTICES

Although meter readers are assigned less than 200 meter reads per day, many are not able to read the full complement of meters. They are required to provide their own transportation without reimbursement. The result is that many "readings" may be estimated or simply falsified. This is a serious problem for the DISCO and for the consumer.

MEPCO declares that meters readers are being rotated. Some subdivisions rotate readers on a monthly basis; others every six months. Rotations may be in form only, as readers may exchange reading lists once out of the office. Trade unions monopolize areas, allowing employees to retain designated routes within specific subdivisions. This leads to a lack of objective meter reader control that in other countries has resulted in developing and sustaining personal income streams through fraudulent meter reading practices. In cases

where meter readers are not rotated, or their function constricted by trade union representatives, this has led to lack of transparency, accountability and required levels of checks & balances for program integrity.

The limited number of readings/audit and the lack of entries in the meter discrepancy log would indicate that meter reading verification/auditing functions should be assigned to a work unit with the specific mandate to undertake these duties.

Bill distribution is performed in the urban areas on a house by house basis, while in the rural areas bills are left at a central location. Since bill delivery requires that the employee provide his own transportation, this leads to less than adequate delivery practices in many cases. This problem leads to delayed delivery wherein consumers receive bills with a shortened period to complete the payment process. Because the bill preparation process is often delayed, the delivery of bills is delayed.

3.4.3.16. THEFT CONTROL

With less than ideal meter reader rotation, opportunities for collusion with consumers are numerous. Practices that can result from collusion include falsifying meter readings (recording low or high consumption as needed) and/or declaring the meter defective when estimated bills would be lower than actual consumption. Because the time required to replace the defective meters is lengthy, invalid meter readings could continue for some months. Collusion could also result in reporting lower consumption levels to ensure that the consumer is billed at the lower slab rates.

There are numerous checks prescribed in the NEPRA guidelines, and adopted by the DISCOs to audit meter readings, but field reports indicate that these procedures are not followed. XENs and SDOs claim they are too busy to make time for meter reading audit procedures.

Meter readings submitted for billing purposes are reportedly influenced by the management of the divisions and subdivisions in order to meet revenue and loss targets. Some consumers are overcharged because of excess readings to compensate for the under billed consumers. Readings may be adjusted to manipulate the slab tariffs to create revenues. Over a period of a few months, the actual meter readings will be correct, but the consumer has been charged at the higher rates which are not fully compensated when the consumption is lowered.

The shortage of staff, especially in the rural areas, has lead to a decrease in surveillance of the system. Aggressive attitudes encountered when disconnecting unauthorized consumers result in employees not even attempting to do so. There are several "no-go" areas even in the city of Multan.

3.4.3.17. METER INTEGRITY AND METER READING PRACTICES

Only meters for large industrial consumers are inspected annually. Other meters are inspected only if there is a discrepancy report or consumer complaint. With a discrepancy is reported, if the meter is defective the M&T team with the SE/XEN/SDO will determine the losses, and a detection bill is issued. If the customer has been overbilled, no refund is made.

When a meter is declared to be defective, the consumer is billed on the average consumption of the last 11 months. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer. Therefore, the reader declares the meter defective and the consumer is billed on the lower estimated consumption. Since it takes 3-4 months for the meter to be replaced, the air conditioning season is over before the consumer is billed on actual consumption.

With meters located 7-10 feet above the ground, it makes it difficult to detect meter tampering. A discrepancy note can be made if the reading produces an abnormal consumption, but exception reports are generally ignored. The quality of service installations is problematic; many of the meters are poorly installed.

3.4.3.18. CUSTOMER INFORMATION SYSTEM

Presently MEPCO's distribution system practices are characterized by manual and cumbersome processes, inadequate controls, insufficient commercial focus, limited transparency and lack of reliable information. As a result, commercial operations are highly inefficient with substantial revenue leakages and poor customer orientation. The use of information technology to improve efficiency and effectiveness is inadequate. Several standalone applications are limiting ability to effectively interface and integrate, either with other applications or with potential applications to be deployed in the future. Although the level of deployment of IT varies significantly from one DISCO to another, the key applications have been in multilevel aggregation of data or large-scale data processing. In other words, IT is being used as a tool to address a specific issue or two at a time and not as a long-term, holistic strategy.

The following are some examples of inefficiencies:

- A number of new connections are pending even after paying the capital cost and security amount, because there is no material available in stores. Availability of service materials is not confirmed prior to issuing the Demand Notice. An integrated materials management and work order module would allow MEPCO to order materials when needed, and connect consumers on a timelier basis.
- MEPCO does not have digital records of paid demand notices.
- Applications for new connections are managed manually (a number of hands and desks are involved), without any level of automation.
- Late submission of consumer consumption data to the Computer Center for billing new connections results in delayed billings and revenue recovery.
- The commercial processes are reasonably well designed, but the lack of electronic technology creates significant delays, and moreover creates major vulnerabilities that can be relatively easily exploited.
- Customer service activities are not automated. One significant problem is that the customer account records cannot be updated real time, i.e. the customer bill is revised manually but in many cases the same amount appears as arrears in next month's bill.
- Delayed billing due to non-dispersed billing/data processing system increases bill processing and bill collection cycles, i.e. the Computer Center awaits data from all subdivisions of all divisions in all 4 circles before processing.
- Only one months' billing information is available on computer master file; and historical data is offline i.e. in tape cartridges. Thus no trend analysis/drilling to find the gray area of operations could be performed.
- Delayed cash processing/posting (more than 10 days in some cases) delays the cash reconciliation process. Management likewise receives much delayed information.
- Delay by banks in remitting money to the company's account due to the cash collection policy.
- No historical/computerized record of service complaints.
- No computerized system for transmission loss calculation.
- Field staff is engaged in a number of duplicate activities, i.e. maintenance of documents/registers at many levels, copying information from one form/register to another form/register etc.
- Unwillingness/resistance by non-IT users to using new technologies is a key obstacle in improvement of the customer/utility relationship.

3.5. HUMAN RESOURCE ASSESSMENT

3.5.1. OVERVIEW

While MEPCO appears to have made significant progress in retailing electric power to its customers, it still faces significant challenges in modernizing its HR policies, procedures, and overall functionality. It has yet to develop a strong and progressive corporate culture, in which management and staff have well-defined and clearly laid out responsibilities, where each is endowed with adequate authority and has appreciated its accountability. For all intents and purposes, MEPCO today employs a facsimile of WAPDA legacy HR policies and procedures; it does not reflect the values and attributes of a modern, independent, and well-managed electric distribution utility. Results of the interview process showed that management is not clear whether it reports to the Board of Directors, PEPCO, or MWP. Partly because of this, governmental (national) as well as internal political pressures are commonly and effectively exerted on MEPCO senior management – which is itself selected by PEPCO rather than by the Board of Directors.

3.5.2. SUMMARY OF KEY FINDINGS

The following are key findings of the PDIP review of human resources management.

- The challenges facing the human resource infrastructure are serious and entrenched, because MEPCO has been subject to both internal and external manipulation – by political sponsors, government agencies, trade unions, and employees themselves.
- The utility lacks a solid corporate culture featuring responsible management and accountable staff., in which management and staff have well-defined and clear responsibilities, and where management is endowed with adequate authority, and all employees have accepted and understand their accountability
- Management is unclear whether it reports to the BOD, PEPCO or MWP, facilitating governmental/political pressure. The Board itself is PEPCO appointed. Partly because of this, outside governmental as well as political pressures are commonly and effectively exerted on MEPCO senior management – which is itself selected by PEPCO, not by the Board of Directors.
- There is a lack of transparency in hiring and career advancement within MEPCO. Clear and transparent HR-related rules and regulations are lacking; without the necessary checks and balances in the system, fairness and impartiality regarding the annual performance review process cannot be expected.
- The compensation system makes no distinction between "performers" and "non-performers," nor does it reward high risk jobs, such as linemen.
- DISCO salaries including MEPCO's are artificially low due to continued adherence to WAPDA salary scales, but while this may result in savings to MEPCO's operating cost, these are in fact artificial savings; perennially underpaid employees do not perform optimally. In other countries, low compensation levels have been linked not only to poor performance but to corrupt work practices.
- MEPCO has not yet drafted updated job descriptions for senior management and key staff positions, retaining those of the Area Electricity Boards. These documents lack clear and specific descriptions of roles and responsibilities; required educational background and professional experience; core competencies; and scope of authority and responsibility.
- While MEPCO provides capacity and safety training at a Central Training Center, the linemen trainees are trained with tools that are not commonly provided to line workers. The line workers are in general not provided basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective fashion in the field.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov

- Health coverage for staff and their dependents is poorly structured and imposes considerable hardships on employees.
- MEPCO senior management has a vision for the utility's future, but this has not been effectively communicated to mid-level management and staff, and is therefore not well understood by employees.
- Recruitment of talented/qualified personnel is inhibited by the lack of effective post descriptions, comparatively low wage scales, and external interference in hiring decisions.
- MEPCO does not employ a corporate performance management system. Instead it uses the standard GOP annual performance review program, not based on goal setting or objective performance evaluation.
- The company has not yet developed an Employee Handbook.
- MEPCO lacks a comprehensive training & development action plan in particular and training/capacity building programs in general. Training offered is mostly aimed at allowing employees to advance within the DISCO system, as opposed to skill development. Training facilities are ill-equipped, with instructors who have themselves not been retrained in many years, and training manuals not updated in two decades or more. The program also lacks post-training impact evaluation.

3.5.3. ANALYSIS & DISCUSSION

Historic WAPDA hiring and promotion processes still prevail in MEPCO as they do in all DISCOs. There exists a lack of transparency in hiring and career advancement process, with career advancement based on seniority rather than performance, and hiring often dictated by external agencies such as MWP and PEPCO. Clear, transparent HR-related rules/regulations and performance standards are lacking,. MEPCO's corporate culture has not evolved to that of a modern, independent electric distribution utility. Employees appear locked in a public sector mindset, where employment rather than performance guarantees continuity and promotion.

As in other DISCOs, MEPCO faces the challenges of commercializing energy distribution over large areas, managing capital resources to finance system expansion and maintenance, upgrading its billing and receipts structure etc. This requires professional HR, management, technical and a variety of other skills and experience.

In the past two to three decades, where there has been substantial expansion in the system, there has been little change in internal infrastructure, policies and procedures. The organizational structure is inherited from the WAPDA years, with little regard to aligning MEPCO to the changed business, engineering and financial environment.

As noted, MEPCO lacks a clear, proactive and structured training and capacity building program. This shortcoming needs to be addressed on a priority basis. Moreover, the company has not yet engendered a customer oriented approach to build trust and confidence in its consumers.

3.5.3.1. MODERN HR PRACTICES

Throughout MEPCO, staff at all levels stressed the need for fair and transparent HR practices. The need is for an HR management system based upon accurate and up to date job descriptions, key performance indicators, and fair and rigorous appraisals. This is necessary to establish the foundation of a progressive business entity. MEPCO has devised a Human Resource Information System which is Oracle Based and fulfills their reporting needs, but the system still needs to upgrade the user interface and develop more detailed analysis & reporting capability.

MEPCO has job descriptions for all positions, but the descriptions are outdated, and there is need for a comprehensive review and modification process to incorporate major function responsibilities and performance indicators.

A modern HR system complete with newly defined policies and procedures would include the following attributes and characteristics:

1. Post descriptions, clearly indicating the main functions, key responsibilities, performance indicators, educational requirements, training certifications and professional demeanor for all positions in the company.
2. A fair and transparent hiring process that allows the HR department to recruit staff in an objective manner, without any external or internal influence and interference.
3. A merit based career and progression structure & policy, which defines the prerequisites for promotion and is applicable to all positions.
4. A progressive and competitive compensation and benefits package, independent of government compensation levels, and adjusted to reflect market rates for all professional and skilled positions.
5. A newly defined health policy that provides increased flexibility to employees, allowing them to seek and receive health care beyond the WAPDA-centric health facilities.
6. An advanced HR Information System which will cover all HR needs, and which is fully integrated with the other departments.

3.5.3.2. ANALYSIS OF MANPOWER

Long-term performance improvement will require significant changes in human resource management, and human resource capabilities. A review of manpower HR statistics was undertaken to begin to understand how resources are allocated, and how well-prepared MEPCO employees are to meet the requirements of their positions. Table 19 below summarizes MEPCO manpower statistics. An analysis of its total manpower shows that 3,255 or 19% are university graduates; a large number, 8,317 or 48% are actually illiterate; while another 33% have education up to tenth class. These numbers are low, but comparatively higher than those encountered in other DISCOs.

Manpower Distribution	**Strength**
TOTAL	**17,201**
Total Officers	494
Total Officials	16707
Regular Employees	15319
Contractual Employees	1860
Daily wages Employees	22
University Graduates	3,255
Secondary Education	5,629
Primary & Complimentary	2,995
Others	5,322
Female	145

Male	17056

Table 19 Manpower statistics

Table19 shows that a significantly lower number of MEPCO employees (8.9%) are categorized in the "Others" category than appear in other DISCOs. Of the entire 17,201 employees, there are only 145 women, which is only 0.8%. This gender imbalance needs to be firmly addressed. There exist significant opportunities whereby women could be hired in areas such as IT, general administration, finance, commercial operations, and customer services.

Employees by Department	**Strength**
Total	**17201**
Executives/ Directors	7
Human Resource Department	83
Finance Department	283
Operations Department	11471
Commercial & Sales Department	911
Administrative Department	712
IT/ MIS Department	216
Health & Safety Department	102
Construction Department	1025
Training Department	48
Audit Department	104
Security Department	704
Others (store, school, civil, other)	1535

Table 20: Distribution of employees by department

Table 21 is a snapshot of MEPCO employees' time in service. It shows that 59% of them have been in service for more than 11 years. This also shows that a significant number of employees have been in the legacy WAPDA organization for many years, and that the challenge of changing the corporate culture will be significant. The demographic distribution shows interesting results; approximately 23% of MEPCO's employees will retire within the next 10 years, and 33% within the next 15 years. Therefore, a reduction strategy relying on attrition through retirement alone can be an effective tool in reducing the utility's overall strength.

Years of Service	**Strength**	**Age bracket (Years)**	**Strength**
0-5 years	3059	30 and below	3,022
5-10 years	4020	30-40	5605

10-20 years	2470	40-45	2846
Over 20 years	7652	45-50	1811
		Over 50	3917
Total	**17201**	**Total**	**17201**

Table 21 Distribution of employees by years of service and age bracket

3.5.3.3. ANALYSIS OF COMPENSATION

DISCO regular employees are compensated through legacy WAPDA "basic pay scales" (BPS), a standard compensation package of the Government of Pakistan. Salary-related benefits such as allowances, bonuses and increments are also treated under the same system. As mentioned above, the system does not reward high performers, or high risk jobs such as linemen who prefer to move to other positions or seek early retirement.

An exception may occur when an employee is hired on "contract" as a DISCO Directors (e.g. of HR, Legal or Finance). The pay package for such personnel is considerably higher than for regular utility employees, and is not constrained by the BPS. The Director Finance was hired on this basis and his salary will thus exceed that of MEPCO's CEO.

Private sector employees are paid several times more than MEPCO employees; the CEO of NEPRA earns approximately four times as much as MEPCO's CEO (see Table 22). An even more striking comparison is that a newly qualified engineer in the private sector would earn a salary equivalent to that of the utility's CEO.

Towards a definitive answer to the question of desired compensation package in a private sector entity, there will be the need for a market-based survey with a much broader scope, and presumably carried out by a professional HR firm. However such a compensation and benefits package will be possible only when the company is freed from government control as is aspired to with the recent reconstitution of the DISCO Boards of Directors by MWP.

MEPCO		**NEPRA**		**NESPAK**		**PTCL**	
	Rs'000		Rs'000		Rs'000		Rs'000
CEO	132	**Chairman/ Member**	382	**CEO**		**President**	Spl Pkg
						Sr. VP	695
Director / Chief Engineer	109	**Director General**	338	**Exec. VP**	278	**Exec. VP**	425
Mgr. / Superintending Engr.	87	**Director**	265	**Gen. Mgr.**	217	**Gen. Mgr.**	287
Deputy Mgr. / Exec. Engr.	69	**Dy. Director**	203	**Principal Engr.**	114	**Sr. Mgr.**	170
Asst. Mgr. / Sub-Div Mgr.	58	**Asst. Director**	140	**Jr. Engr.**	84	**Asst. Mgr.**	90

Table 22 Comparison of MEPCO and other institutional salary levels.

3.5.3.4. ORGANIZATION

The organizational structure employed by MEPCO and other DISCOs is designed to employ distribution circles as large geographic management units managed as full service utilities – minus engineering planning. Circles are managed by Superintending Engineers who are empowered with responsibility to manage all operational activities except planning and engineering functions, which are managed at the MEPCO HQ level. That is, commercial functions (meter reading, bill processing, and bill delivery); line operations, connections and disconnections are all supervised by the Superintending Engineer and his staff at the circle, division and sub-division levels. Payments are made by consumers to designated pay points; DISCO employees do not handle payments from consumers.

This arrangement creates an internal conflict within the distribution circle; since commercial operations are the cash register of any utility, the commercial department should not report to the operations department. The operations department manages the operation and maintenance of physical assets, focusing on power quality and reliability. The commercial department measures the success of the operations department through the billing process and therefore must be independent and managed by personnel with the required educational & experiential background, as well as institutionally oriented objectives aimed at optimizing distinct objective functions. Commercial activities aim to effectively manage the processes of connecting /disconnecting services; metering energy consumption; recording consumption data; billing consumers for energy consumed & other services provided; and collecting receivables from consumers. Distribution system operations focus on maintaining distribution system infrastructure, including recording bulk energy transfers into & out of substations; performing substation and line maintenance; and management of minor system expansion activities.

MEPCO's present organizational structure has commercial personnel reporting to engineering managers, circle managers reporting to the CEO; and far too many managers reporting to the CEO, whose principal responsibility is ensuring the DISCO's financial sustainability. Engineering planning, operations, commercial functionality, administration, and financial management should be routinely managed by highly competent managers without CEO involvement, other setting objectives and reviewing progress towards these higher level achievements. The assessment at MEPCO showed that an Executive Engineer is occupying the post of Company Secretary. This position should be filled by a Manager who is a legal professional with expertise in Corporate Law.

3.5.3.5. HUMAN RESOURCE ORGANIZATION AND MANAGEMENT

The Human Resource Department of MEPCO is designed to address the organizational needs of obsolete WAPDA-era Area Electricity Boards. The department is ad-hoc rather than proactively oriented, thus not conducive to furthering MEPCO's success as a business–based utility. However, the Director (HR/A) has taken some steps to modernize the department: an HR Information System (HRIS) has been built to provide a reliable HR database for reference, planning and forecasting. Similarly, the Regional Training Center has been upgraded to conduct managerial training for management staff, a facility found to be absent in all other DISCOs.

The Legal Department is under HR, and likewise centerd on labor/service issues, with no capacity to handle the company's corporate & regulatory affairs.

3.5.3.6. HEALTH AND SAFETY

In MEPCO safety training does not meet the needs of line workers as evidenced by the high number of accidents in the recent years. In the past 3.5 years there have been 78 accidents resulting in 36 deaths and 42 injured (see Table 23 below). Most of those injured have become permanently disabled and cannot be assigned to any active duty but receive their salaries and benefits till retirement. MEPCO has not developed a safety program with policies & procedures governing linemen working conditions; providing ongoing

training, establishing an incident reporting/evaluating system for workplace injuries, and enforcing safety practices in line construction, maintenance and system operations.

PERIOD	EMPLOYEES		TOTAL
	FATAL	NON FATAL	
2007-2008	11	10	21
2008-2009	11	13	24
2009-2010	7	15	22
07/2010-12/2009	7	4	11
Total	36	42	78

Table 23 MEPCO accident statistics 2007-2010.

Safety is insufficiently emphasized vis a vis employees and consumers alike; There have been no awareness programs to educate the public regarding the proper use of electric power – and the risks involved in inappropriate contact with power systems.

Such a program will require a significant investment in training, protective gear, tools, and program monitoring. It will require a cultural shift in the workplace, aimed at dramatically reducing accidents and deaths. Also, as noted before MEPCO employees/dependents would benefit from a diversification of health care options from the dedicated WAPDA facilities still prevalent.

The health coverage for the employees and their dependents is poorly structured and involves considerable difficulties. The current health care system deprives employees and/or their dependents to obtain medical care (out-patient and in-hospital) of their choice. Employees and dependents are forced to use the WAPDA central hospital in Multan or a peripheral health care center, requiring considerable travel, or which do not possess the facility or required services. Alternatives, such as better health care through insurance, or paying a fixed proportion of salary for outdoor treatment, have not been evaluated or brought up for serious consideration.

3.5.3.7. RECRUITMENT

Effective recruitment as noted previously begins with well-defined post descriptions specifying core competencies, experience, responsibility/authority levels, and compensation. Once these attributes are defined, the HR Department can advertise for candidates to fill vacancies both within and outside the company. The current specifications are too general for the above purposes and require urgent revision; as do the present remuneration packages towards engaging able and qualified personnel as MEPCO's top management tier.

Lastly, the recruitment process itself is often short-circuited through direct appointments by PEPCO and/or MWP, violating the concept of an independent electric distribution utility, and forcing MEPCO and other DISCOs to absorb personnel unsuited for positions they fill. A more objective, transparent process needs to be instituted likewise.

Out of 1528 employees recruited during the period Jan 2009 to Nov 2010, 396 or 26% were based on the employee quota system. This established annual exercise across the DISCOs/public sector entities also undermines professional competence. The Team has proposed that a change in this policy be considered subject to its acceptability to management, employees and the union.

3.5.3.8. PERFORMANCE MANAGEMENT SYSTEM

MEPCO does not employ a corporate performance management system. In 2009 it changed the annual evaluation system from WAPDA/govt.'s ACR (Annual Confidential Report) to the PEPCO-pattern PER (Performance Evaluation Report). This is however essentially the same report in another format, lacking goal setting & performance evaluation, and only shared with the employee if adverse.

As noted, an effective performance management program needs to be defined and implemented. The process should include goal setting, discussion between employee and supervisor at year commencement, and an objective review & evaluation process at midyear and year end. Advancement should be based on achievement rather than only on seniority, enhancing employees' incentive to specifically improve skills and generally invest themselves in their jobs.

3.5.3.9. HR POLICIES AND PROCEDURES

MEPCO has not developed a consolidated, accessible set of HR policies/procedures manuals for staff and management. From recruitment to retirement, clear cut rules & regulations are required. The longest serving HR Department staff are usually those most conversant with rules/regulations and where to find them. Staff, particularly from outside this department, are therefore dependent on the HR Department even for minor matters e.g. leave sanctions, etc. In such a scenario, transparent and equitable HR operations are impossible. Where policies/procedures do exist there is an inadequate implementation, allowing the intervention of influence both internal and external.

3.5.3.10. EMPLOYEE HANDBOOK

MEPCO has not yet developed an Employee Handbook, a concise document providing essential guidance to employees on policies and procedures – the Do's and Don'ts. Ideally, this should be available on the web and in booklet form both in Urdu and English.

3.5.3.11. TRAINING AND CAPACITY BUILDING

As mentioned, MEPCO's Regional Training Center is better maintained than those in the other DISCOs. However it requires highly improved training materials, and compliance with standards. Based on discussions with training staff and visits to the facilities, it is clear that training tools, manuals and other aids are inadequate to meet the utility's growing needs. For instance, linemen are trained with tools that are not commonly available or provided to the line workers. The line workers are, in general, not provided basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective manner.

MEPCO does not have a comprehensive training and development action plan, and generally lacks training or capacity building programs. This has caused a serious functional skill deficiency among its employees. The training that is offered is mostly targeted to allow employees to advance within the organization that is preparing employees for promotions. Training is not really oriented towards substantive skill development. MEPCO has not designed or implemented an effective needs assessment plan which is needed in order to design future training programs. The training facilities are ill equipped, with instructors not retrained in many years, and training manuals developed in the 1980s (under a USAID program) and not since updated. The training department has developed no post training impact assessment/ evaluation mechanism.

While a complete training needs assessment will be needed for MEPCO to provide a detailed identification of specific training needs, the PDIP team has identified essential training needs that should be addressed at the earliest possible date. These include, but may not be limited to the following:

Commercial training:

1. *Meter reader training.* This training should focus on familiarizing meter readers with new metering technologies such as: using handheld electronic meter reading devices; identifying and recording meter faults, meter tampering, and meter maintenance requirements; and carefully recording and transcribing data.

2. *Improving basic computer skills for commercial staff.*

3. *Customer service training.* This would orient commercial staff to think of and treat customers as valued clients.

Engineering & Operations training:

1. *Safety management program.* Establish a safety management program, and provide basic and advanced safety training to MEPCO linemen and line superintendents.

2. *Work planning management.* Train line crews to work more effectively to complete tasks on time/schedule. Concurrently train line crew supervisors to manage crews more effectively.

3. *Area planning and mapping.* While the long term goal for engineering staff will be to develop and deploy GIS systems, in the interim MEPCO staff could and should develop improved manual mapping and planning tools.

4. *Line design.* MEPCO and other DISCOs do not actually design distribution lines. Rather, they use rules of thumb as proxies for engineering design practices and procedures. This results in high cost, and often in inappropriate line design.

5. *Metering theory and practice.* This would focus on training engineering staff on a variety of metering options, meter types, and metering applications.

Finance & Accounting

1. *Internal audit training.* MEPCO internal auditors focus on only one of several internal audit obligations as outlined in the Internal Audit Manual – identifying low/inaccurate meter reading. Internal audit obligations are far broader than focusing merely on meter reading.

2. *Updating Accounting Manual.* Training accounting staff in accounting best practices as specified in the revised Accounting Manual. Providing training in compliance with the chart of accounts.

Human Resource Management

1. *Basic computer competency training.* MS Office applications, management of the HR database. Human resource staff needs to improve basic computer skills to manage modern HR software.

2. *Human resource planning and forecast training.* This is a more specialized training aimed at improving the overall capacity of the HR Department to undertake manpower planning and assess training needs.

3. *Annual performance evaluation program design and training.* To familiarize all personnel with the performance evaluation program.

4. *Capacity building for trainers.* This is an important training of trainers program.

3.6. COMMUNICATIONS AND OUTREACH ASSESSMENT

3.6.1. OVERVIEW

MEPCO is geographically one of the largest distribution companies in the Punjab province, covering the whole of Southern Punjab. It distributes electricity to ~ 4 million consumers. It is thus a formidable challenge for MEPCO to have efficient internal communications and effective outreach capacity for such a large population and territory, especially when issues like power generation deficit and increasing tariffs are becoming mounting challenges for distribution utilities.

Despite being an independent entity, MEPCO has not been able to break away from the policies and administrative controls of PEPCO, WAPDA and MWP. Its internal and external communication practices are based on classic public sector patterns of notes, letters, memos, office circulars, etc. This practice prevails as concerted efforts have not been undertaken towards a modern communications culture. ERP has not been implemented so far for one reason or another. However, a few half-hearted efforts were made with insignificant consequences.

MEPCO faces similar challenges in external communications. The company has not been able to develop a progressive and independent corporate image. The task becomes even more challenging owing to PEPCO's overriding influence, leaving little autonomy for MEPCO to undertake independent media campaigns and outreach activities. The Public Relations (PR) department is responsible for external communications, but with no specified budget. Its main functions include daily press reviews, preparing press summaries for the CEO, media briefings, and coordinating outreach activities. PEPCO manages mass media campaigns, whereas MEPCO only contributes its financial quota as a partner DISCO.

The following sections offer observations and analysis of the utility's internal & external communications and outreach activities, and offer recommendations for priority areas:

3.6.2. SUMMARY OF KEY FINDINGS

Following are the key findings regarding MEPCO's communications and outreach practices:

- **Internal Protocols and Practices of Communication:** As noted, these are based on public sector patterns of correspondence and communication, featuring limited information access. Speed and flexibility in successful business operation are obvious casualties.

- **Corporate Communications and Consumer Outreach:** The PR department only manages local media liaison. Due to its absence on the mass media stage, MEPCO has no corporate or consumer image/profile.

The PR department is not considered at par with other operational departments, hence there is no annual plan or budget for its internal /external communication activities.

- **Limited Role of the MIS Department:** The potential of this department as a change agent for internal communication has not been adequately explored. So far its role is largely confined to bills processing, printing and sundry other data-processing activities.

- **Low IT Penetration:** Computer literacy at the management level is very low. Computer usage as a preferred mode of communication, information management and data processing is not widely practiced.

- **Media Mix and Products:** There is a need to further explore the role of consumer outreach activities and to supplement media liaison for image building as noted. Currently such activities are isolated and needs- based rather than systematically and annually planned.

- **Customer Service Centers: These** centers are set up at subdivisions, divisions and circles. They have modest office infrastructure with manual record-keeping. The staff in the centers has not received adequate training in customer service, which needs to be addressed.

3.6.3. ANALYSIS AND DISCUSSION

In view of its geographic spread and consumer base, MEPCO needs to establish a comprehensive and efficient internal and external communications system to create a progressive corporate and consumer image. Public awareness campaigns need to be implemented. Similarly its organizational communications and practices need to become proactive and MIS oriented. The resistance of management and staff to these institutional – largely because unfamiliar – changes likewise needs to be overcome, and involves a paradigm

shift in the organizational mindset. Fortunately, the majority of the management recognizes and desires the necessity for this change.

The need for improving communications and outreach has been historically overlooked owing to MEPCO's preoccupation with its core operations as a distribution company .The less tangible nature of communications/outreach has eluded the company's corporate attention.

3.6.3.1. INTERNAL COMMUNICATIONS PROCESS

For a large organization like MEPCO, internal communication has two major aspects;

1. The mode and tools for inter and intra departmental official correspondence, data storage and handling of information.
2. Availability, ease of access, speed and effectiveness of communication with field offices and field staff.

As detailed above, MEPCO's communications culture is archaic and rigid. Information belonging to the public domain e.g. general operational data, service rules and regulations are not readily accessible. The persistence of WAPDA, PEPCO and MWP patterns are reflected even in details like MEPCO management visiting cards.

3.6.3.2. INTERNAL COMMUNICATIONS POLICIES AND PRACTICES

MEPCO has inherited its internal communications policies and practices from its predecessor organization - WAPDA. Despite being an independent entity, MEPCO follows the policy and administrative controls of PEPCO, WAPDA and MWP. This relationship has influenced the practices of internal and external communications, so much so that the visiting cards of few senior management staff mention WAPDA along with MEPCO.

The internal communications culture is driven by manual modes of correspondence delivered by typical diary system. This traditional style of internal communication has direct bearing on speed, openness and flexibility.

3.6.3.3. ADOPTION OF INFORMATION COMMUNICATIONS TECHNOLOGY

Information/correspondence/data management is not current practice in MEPCO. Delay in the implementation of ERP is also a significant challenge in the company's transformation to a more effective, efficient corporate entity.

Compared to senior and middle management's lack of computer conversance, entry level managers are more technologically oriented. At present about 250 computer terminals are being used in MEPCO offices. The MIS Department informs that very few of the over 150 official e-mail addresses issued are regularly used. Nor is the web portal interactive or accessible, requiring revamping to explore its true communications potential.

Management of corporate data, rules and documents through information technology is systematically practiced only by the MIS Department, which has demonstrated its ability to develop useful data processing modules for HR and other departments. If electronic business environment is promoted as an efficiency tool and best management practice, the MIS Department has the capability to impart training and supervision to management to facilitate transition from an obsolete to an effective system of internal communication.

An adequate and reliable database of employees, rules, regulations and operations not being easily accessible, employees are forced to rely on manual records, hindering prompt and clear communication. This indicates the inevitability of a corporate shift to modern communications technology and across-the-board training.

3.6.3.4. COMMUNICATION FOR TEAM BUILDING

MEPCO undertakes few team building activities, limited to safety awareness events, or staff get-togethers for retiring employees. No significant activities such as special events, Eid celebrations, commemorations, seminars, family gatherings, staff functions, or open houses are organized.

3.6.3.5. EXTERNAL COMMUNICATION

The utility as mentioned earlier is facing a major challenge in developing a progressive and independent corporate image, owing to PEPCO's overriding influence and its own resource-constrained inability to undertake outreach. Therefore MEPCO's credibility is subject to constant demand side communications challenges from power shutdowns, tariff increases, electricity surges, and quality of its aging distribution system.

3.6.3.6. THE PUBLIC RELATIONS DEPARTMENT

Though responsible for external communication, this department does not have an adequate budget for this purpose. It is headed by a Deputy Director assisted by two staff members - a computer operator and a photographer. Major activities carried out include daily press scanning to prepare summaries for the CEO and issuance of press releases. The department is the focal point for local media and public relations for the CEO in particular and the organization in general. Mass media campaigns are managed by PEPCO where MEPCO only contributes its share in the resource pool as a partner DISCO. It has no role in the selection of an advertising agency, media mix and frequency of media campaign.

The mandate of the PR department includes:

1. To review national and regional press coverage and prepare a daily summary for the CEO.
2. To prepare and issue press releases on MEPCO's activities, public notices, procurement notices, shutdown announcements, etc.
3. To liaise with local press and electronic media for clarifications and media coverage.
4. To maintain liaison with PEPCO for corporate and external communication activities, media queries and Press Information Department (PID) for listing of approved newspapers.
5. To liaise with the designated advertising agency – Midas (Pvt.) Limited - for preparation of press and electronic media campaigns.
6. To arrange compilation and publication of a monthly newsletter to report organizational activities.
7. To manage development and printing of promotional and informational material eg. posters, leaflets, newsletters etc.
8. To coordinate outreach activities including seminars, events, radio talk shows and press briefings on corporate and power-related issues.
9. To undertake any other activity related to media, and development and printing of material.

3.6.3.7. OUTREACH ACTIVITIES

The outreach activities carried out during the last one year have been sporadic and need-based. These include a few seminars, and posters/leaflets on power safety & energy conservation. The company publishes a monthly newsletter highlighting the activities of MEPCO.

3.6.3.8. CUSTOMER SERVICE CENTERS

MEPCO has customer complaint centers at the circle, division and subdivision levels. The staff deputed to these centers works on an ad-hoc basis. Currently the staff from field operations has been diverted to attend customer complaint centers for a designated time period.

The customer complaints record is maintained manually. The use of ICT is not prevalent at the centers which lack connectivity in most cases. It is encouraging to note that an elaborate system exists for follow-up and coordination with other departments, to ensure that complaints are closed promptly. However efficacy of record keeping and enhanced customer service can be enhanced by digitization of manual data, and

developing a permanent database for record and complaints. Customer complaint centers also do not display sufficient informational material for incoming consumers. MEPCO needs to develop, display and disseminate information, education and communication material such as posters, brochures and flyers; highlighting the process of complaint handling, the chain of supervising officers and the salient points of customer service guidelines.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. GOVERNANCE

The Board of Directors does not function effectively as a corporate board. The CEO is appointed by PEPCO, and not hired by the Board. There is no BOD Audit Committee. The reconstituted Board it should appoint an Audit Committee with an independent financial expert and a direct reporting relationship to the organization's Internal Audit Department. The new BOD will need both governance and electric utility training. Its newly defined Directors will require training to prepare them for the challenge of governing MEPCO in the changing utility environment in Pakistan, and to advise Board Members of their roles and responsibilities vis-à-vis the MWP, NEPRA, and other stakeholders in the power sector.

The BOD should be formally established, through an agreement with the government, as the independent governing body with ultimate decision-making authority, and in general be empowered to (1) set the company's policy, objectives, and overall direction (2) adopt bylaws (3) appoint members to the advisory, executive, finance, and other committees (4) hire, monitor, evaluate, and fire the Chief Executive Officer and senior executives.

4.2. ENGINEERING

The Engineering Results section of this report presents the process whereby the PDIP engineering team prepared an evaluation of MEPCO's distribution management system, and the results of a mapping and loss assessment effort. It will present the conclusions of the team resulting from their observations and calculations, as well as recommendations of opportunities for improvement.

4.2.1. TRANSMISSION NETWORK

The PDIP team did not carry out any specific analyses of the transmission network as MEPCO is upgrading all of its 66 kV transmission and grid substations to 132 kV at a fast pace, and it was clear that the major problems were in distribution. Adequate planning practices appear to be in place to ensure that the transmission network is appropriately expanded.

4.2.2. PLANNING PROCESSES

MEPCO's planning management clearly understands the need for integrated distribution planning as a means of arriving at an optimum distribution network design. The two prerequisites for integrated planning are accurate geographical maps, and analysis software that is easy to use and can incorporate geographic input. The MEPCO Planning Department has put considerable effort into the development of system maps prepared through local consultants/contractors. As a pilot project, a total of 38 11kV feeders were selected for complete mapping. Satellite images for the areas being served by these grid stations have been procured, and field survey has been contracted out. Field survey information is later superimposed on satellite images to generate maps with each structure and distribution equipment. This is an admirable undertaking and has resulted in fully mapping selected substation service areas.

A more efficient mapping method would be the use of GPS units to locate facilities in the field, followed by transfer of the information to a GIS. This would make the information available for direct transfer to more sophisticated analysis software that can directly accept digital input. MEPCO could undertake a full scale GIS mapping effort with little more than some additional training and induction of GIS trained staff. Advanced

analysis would require the purchase of a new analysis software package, but this cost is small in relation to what has already been expended on the existing system. The utility could then have a fully up to date mapping and analysis system.

4.2.3. STANDARDS AND SPECIFICATIONS

The updating of standards and specifications is handled by NTDC's Design and Standards Section. WAPDA construction standards have generally served MEPCO well, and there does not appear to be any immediate need to undertake significant alternations in these standards, with two exceptions:

- Transformer standards require review in the current environment of high cost power. The Section has issued a revised standard calling for a 27% reduction in maximum allowable losses for transformers, but much more can be done to lower transformer losses. In dense systems such as Multan City, transformer losses account for half of total technical loss, and even the revised standards allow almost twice the losses as can be achieved with more modern technologies. Wound core and amorphous core technologies need to be explored.

- Open conductor LT is an invitation to theft, as well as a source of consumer outages. MEPCO has placed an order for the procurement of 110 km of ABC and should consider standardizing multiplex or ABC types of LT construction, as opposed to the ad-hoc solution of occasional use of covered conductor in a standard open wire configuration.

4.2.4. PROCUREMENT EFFECTIVENESS

The PDIP team observed that the procurement process followed by MEPCO fails to take advantage of the principal opportunity for reducing the costs of materials, and that is the economies of scale. The company procures a large amount of goods annually, which should give considerable leverage in obtaining favorable pricing. However the WAPDA-established procurement process breaks this relatively large quantity of procurement into over 100 separate solicitations, largely diluting the benefits that could be obtained. When WAPDA was a government agency, this procurement breakdown was necessary to ensure that all vendors received some portion of the orders, but now that MEPCO is corporatized, it is less appropriate. The need to handle such a large number of solicitations also introduces a considerable overhead burden on the utility.

A byproduct of breaking the procurements into small parts is to discourage international suppliers who can often source material from a number of countries and offer better pricing and higher quality. Again, this may have been appropriate when WAPDA was a government agency and it was considered to be policy to encourage local suppliers, but any action that limits the size of the bidding pool increases cost and tends to reduce quality.

While there is no absolute method for determining the ideal size of a solicitation, it is likely that MEPCO's needs for materials could be satisfied by 8-10 procurements a year, two each for poles, hardware and accessories, cable and conductors, and transformers. Special purpose solicitations may be necessary for turnkey items such as substations, but even these should be few and large. It may even be possible for sharing of procurements between DISCOS, allowing for increasing the size of procurements to levels that would be definitely attractive to international vendors.

Another observation is that the Procurement Division does not seem to have the ability to purchase small quantities of materials to make up shortages. Since most vendors are national, there should not be any difficulty in procuring small lots of specific items necessary to fill a project material list, but this is not currently being done. The use of solicitations for all procurements is no doubt a legacy of WAPDA's government history, but a corporation needs more agility than can be provided by an insistence on solicitations as the sole opportunity for material procurement. The use of larger, fewer solicitations to procure the majority of the required material at low cost can be combined with flexibility for purchasing of small quantities on the local market when needed, to provide a more efficient procurement system.

4.2.5. CONSTRUCTION QUALITY

Construction at MEPCO is carried out almost entirely by employees, making no use of contractors for anything but erection of concrete poles. The usual argument for maintaining a large construction staff is that it is necessary to ensure quality construction, and it is true that construction quality in MEPCO is generally good. However, the PDIP team determined that the utility's construction department is entirely self-policing, that is there is no cadre of staff identified as construction inspectors, nor does the department contract for external inspection services aimed at quality control. As a consequence it is difficult to ensure quality of work, with some crews doing a reasonable job and others not.

One practice of the construction department that does cause failure in service, as reflected in the frequency of maintenance calls, is the failure to use connectors on jumpers and other joints. It is clear that at one time MEPCO construct cadres did use connectors, but no new installations have them. All joints appear to be made with wrapped or "served" aluminum strands. No matter how neatly this is done, it is bad practice and will result in a failure of the joint, especially if it is a high current LT joint. The standard connector specified by the WAPDA construction standards is a two bolt aluminum parallel groove connector, which is admittedly expensive. However, parallel groove compression connectors are cheap and simple to install, with hand operated tooling, and providing far superior connections with much lower resistance than wrapped joints.

4.2.6. OPERATIONS

The operations subdivisions at MEPCO are responsible for many activities, but those upon which they place the most emphasis are commercial operations such as meter installation, meter reading, and disconnection of defaulters; and continuity of service tasks such as repairing of faults.

The PDIP engineering team found that at the subdivisions procedures do exist for almost all tasks, but subdivision staff was very reluctant to comply with these, particularly with such record keeping tasks as measurement of transformer loading and rebalancing.

The team did find that the subdivisions are both understaffed and underequipped for their assigned tasks. It was commonly stated that roughly half the linemen are not able to climb, while lack of equipment reduces the ability of ground bound assistant linemen to be of any assistance. Thus even large crews are limited to watching a single lineman on a pole or in a tree and are not productive. Tools, both hand tools and heavier equipment are in poor condition, and inadequate in quantity. There are no tools such as blocks and tackle for lifting, handlines for transferring items up the pole, or wire handling tools such as grips and come-alongs for tensioning conductors. Tree trimming equipment consists of an ax, while trimming shears and pruning hooks are mainly ornamental and too dull and weak to be of value. Transport is limited and most jobs are handled by the linemen traveling on their own motorbikes.

In addition, safety emphasis is very limited with no recurrent training, no safety meetings, and no safety program for enforcement of rules. Protective equipment such as safety belts and grounding sets are of poor design that do not serve the required purpose. The result is a startlingly high fatality rate among linemen, and unwillingness on the part of assistant linemen to undertake the tasks of climbing linemen. Linemen fatalities are blamed by management on a refusal to wear protective equipment, but the PDIP team finds this an unconvincing argument at best. Safety programs must have enforcement provisions, but it is the responsibility of MEPCO management to provide appropriate equipment and recurrent instruction in its use and care.

4.2.7. METER SECURITY

The PDIP team found that the security of the meter itself has improved in recent years with the advent of electronic meters that cannot be opened by normal means even when the seals are removed. Innovative power thieves have succeeded in violating these meters, but there is no question that they are more resistant to tampering than the older electromechanical meters. However the primary threat to meter security is not the meter itself, but continues to be the service drop and the connections to the meter which are completely unsecured, as well as the LT network which is still composed of bare conductors. MEPCO has taken no

steps toward providing improved security for exposed connections and service conductors, and for conversion of vulnerable LT to covered conductors.

Another concern is the existing fleet of electromechanical meters, numbering in the millions, that are still in service on the system. These meters were in most cases not highly accurate to begin with and age has not improved their performance. They have not been calibrated since installation, and while it is certainly in the utility's long term interest to replace them, to the extent that they can be brought to a reasonable level of accuracy through inspection and calibration they can improve the commercial loss situation.

4.2.8. TECHNICAL LOSSES AND LOSS SEGREGATION

The PDIP team carried out a mapping and modeling effort on a sample of the feeders, transformers, and LT networks in the MEPCO system, with the objective of determining the level of technical loss. The sample chosen was representative of the system as a whole and so its losses can be taken as a proxy for the technical loss of the overall system. The technical losses in the distribution system for MEPCO were found to be 8.61%, broken down as follows:

- Conductor Loss 4.94%
- Transformer Loss 2.62%
- LT Network Loss 0.93%
- Service drop loss 0.11%

This estimate for total technical loss of 8.61% was confirmed using a benchmarking technique that is independent of any system modeling, and so is likely to be a valid estimate for overall distribution system technical loss.

This level of technical loss can be compared to the total distribution network loss of approximately 15%, indicating that commercial losses are on the order of 6.4%. This shows that MEPCO's major challenge in loss reduction is in the area of commercial loss, although important opportunities still exist in reduction of technical loss.

4.2.9. OPPORTUNITIES IN LOSS REDUCTION

The opportunities for loss reduction in MEPCO are more on non-technical side but at same time technical loss reduction also needs concrete measures.

4.2.10. MAPPING AND PLANNING IMPROVEMENTS

- *Generation of a detailed load forecast.* Load forecasting, when driven by demographic and economic information, can help identify areas where attention is required.

- *Use of GIS for mapping.* Introduction of GIS for mapping will speed the process of generating useful maps, and eliminate much of the manual labor involved in the current process. It will allow the automated transfer of system information to advance planning software, speeding the production of integrated plans, and allowing the planning staff to identify areas in which interventions are required for loss reduction.

- *Application of advance planning software.* Advanced planning software that accepts digital input from GIS databases and has a graphical output can speed consideration of alternative system designs, and assist in developing integrated distribution plans. Use of such software will allow for consideration of potential problems before they result in high losses or poor service quality.

4.2.11. HT IMPROVEMENTS

MEPCO's average feeder length is almost 73km, which means that the system has many rural areas. HT improvements are of interest mainly on rural feeders where, due to their longer length, there is more conductor loss. Opportunities are:

- *Application of capacitors.* The installation of capacitors that could improve power factor on the sampled feeders 95% would reduce losses by 27% on the longer sample feeders.

- *Selective reconductoring.* The majority of the high conductor loss is to be found in the first 10% of feeder length, where the load is heaviest. Replacement of the commonly used Dog conductor with Osprey would reduce losses by 50% in these segments of line, without the need for bifurcation or addition of new breaker positions.

- *Development of improved transformer specifications.* That would dramatically reduce transformer losses. Transformer losses reflect 30% of MEPCO's technical loss, and technologies exist to cut even the current new specification losses substantially.

- *Review of long feeders (over 60km in total length) o*n the basis of voltage drop rather than thermal capacity. The current method of identifying problems only when conductor loading exceeds 300 amps is inappropriate for long rural lines. These circuits have already entered into voltage problems and high losses long before reaching the 300amp threshold.

- *Application of compression connectors for most taps and other joints.* So as to eliminate jumper burnouts. Points at which sectionalizing is done would be retrofitted with bolt-on connectors to facilitate disconnection. Replacement of wrapped joints would reduce callouts for jumper failures and improve service quality, though the impact on losses would be small.

4.2.12. LT IMPROVEMENTS

- *Preparation of a census of consumer locations.* So that consumers can be linked to the transformers that serve them in the CIS. This would allow for improved transformer load management, as well as providing an opportunity for evaluating losses on a transformer by transformer basis, using portable measuring instruments to correlate transformer loading and sales.

- *Selective replacement of open wire LT line with multiplex or ABC.* To reduce vulnerability of the system to casual hooking. A side benefit of this action would be a reduction in the incidence of transformer damage due to short circuits occurring on the open wire LT.

- *Relocation of transformers.* So that they feed the center of an LT sector rather than the end. This would reduce losses on the affected LT sector by 50%. The incidence of end-feeding is uncertain.

- *Retrofitting of compression connectors for jumpers and other high current joints, and improvement of the connections to the LV bushings of transformers.* The present system of wrapped joints produces a significant level of callouts for overheated joints, which though not a loss issue, does affect consumer service quality.

4.2.13. METERING IMPROVEMENTS

- *Introduce an electromechanical meter testing program.* That is oriented toward ensuring accuracy of electromechanical meters until they can be replaced with electronic units. This would be combined with an accelerated program for changing electromechanical to electronic meters.

- *Evaluate options for improving the security of meter installations.* By using connection boxes and neutral concentric cable as opposed to unguarded open installations. The customer cannot be given access to meter bottom connections, or the installation has no security at all. Neutral concentric cable encloses the cable in a grounded sheath so that any attempt to penetrate the cable with a sharp item such as a nail or an awl will cause a short circuit and defeat the attempt at penetration.

- *Investigate the use of socket type meters.* Which provide greater security for meter connections, and have larger high current connections, allowing them to be applied for direct reading up to 320 amps. This would reduce the number of CT type meters that have to be installed, removing the CT accuracy as an issue.

- *Replace most of the current stock of CTs in use in industrial metering boxes with either direct reading meters or higher quality CTs.* There have been a number of instances of CT failure, which of course compromises the meter reading.

- *Work with meter manufacturers to improve the security of indirect meters (CT and CT/PT installations).* The current crop of electronic indirect meters can be reprogrammed from an optical port to alter the meter multiplier. This creates a vulnerability to any person with the correct software and the optical programming wand, all of which can be obtained at low cost in various markets.

4.3. FINANCIAL MANAGEMENT

While MEPCO collections for the current assessments of private customers are reportedly at 85%, there remains an on-going problem with government collections. Government collections were only 53% of current energy sales to government clients in FY 2010. Given MEPCO's role as a quasi government agency, it has proven impossible for MEPCO to treat government clients on an equal commercial level as other clients. If a government client does not pay, MEPCO is slow, and in some cases unwilling, to take the measures needed to collect from these clients.

As reported in the results chapter of this report, MEPCO has a reasonably effective arrangement with the banking system and other local payment centers to collect funds from its consumers. This arrangement ensures that collections are managed effectively and relatively efficiently. However, there are two issues with the collection system that is being used. First, many collection points – including some banks – retain customer payments to MEPCO for much longer than they should. The pay points should transfer funds on a daily basis, but many retain the receipts for as long as 3-4 days. Approximately 75% of cash receipts are received on the same day they are paid to pay points at the MEPCO principal bank account. Approximately 14% of cash receipts are received through offline banking transactions which involve a 3-4 day delay in getting to MEPCO's account. The remaining 11% are receipts from post offices which may also take 3-4 days. Remittance of these funds from MEPCO to the CPPA in payment of purchased power is important, and creates a significant loss from the perspective of the CPPA.

A principal area in which MEPCO needs to progress concerns ERP framework implementation. This system will provide the means to integrate business, human resources, engineering, asset management, work plan management and operations into an electronic environment that can be used real time in all phases of MEPCO operations. Enterprise systems offer the opportunity to convert manual business and distribution operating systems to electronic, computerized management systems. The ERP software system interface will allow other applications to be integrated with Oracle based system applications, and permit full system interface with all applications. This will be important as MEPCO transitions into CIS, billing systems, GIS and other applications

ERP can allow electric utilities to employ financial and management controls that would otherwise be absent. Full implementation of ERP at MEPCO for example will allow an internal control audit to identify vulnerabilities in accounting and work flow management, and to address these vulnerabilities through improved controls and management processes.

MEPCO needs to expand and enhance internal audit practice and procedures established in 1985, and not updated since. The legacy WAPDA Audit Manual is too narrow in scope to effectively audit MEPCO's financial and functional activities, and inadequate for performing auditing procedures in an ERP environment.

It is interesting to note that the Internal Audit Division has only partially complied with the scope defined in the existing Audit Manual that states the Division should 'ensure that rules and orders framed/adopted by the Authority from time to time in connection with execution of works, pay and allowances, stores etc. and for maintenance of various accounts, books etc. are followed by all WAPDA formations/offices, and the defects and irregularities noticed in such accounts/ books rectified as far as possible." At present MEPCO's Internal Audit only functions by reviewing certain transaction based activities, rather than reviewing its internal control systems as a whole.

The MEPCO Accounting Manual has not been revised since 1985; like the Audit Manual, there is an immediate need to revise and update and improve this. Once NEPRA defines the chart of accounts, the manual will need to be normalized to comply with the new requirements.

There were a number of instances of government involvement noted which constrained and hampered the operations of MEPCO. These include:

- PEPCO has currently placed a ban on the purchase of new vehicles although one third of the vehicle fleet is 20 years of age or older.
- PEPCO is de facto authority for approving ERP implementation and certain appointments and new positions.
- All DISCO investment projects are required to be filed with the Planning Commission (PC), CDWP and ECNEC for approval regardless of funding status. A very burdensome process.

4.3.1. FINANCE AND ACCOUNTING RECOMMENDATIONS

1. Complete implementation of an ERP platform, and expand applications to serve all finance and accounting needs in line with control, management, and financial reporting to the MEPCO Board of Directors, NEPRA, and MWP and Power as needed.
2. Revise and update the Accounting and Internal Audit Manuals in line with the movement to modernize MEPCO; to increase its internal auditing scope to more effectively assist the BOD, and adjust to the new ERP environment.
3. Evaluate means of improving transfers from paypoints to MEPCO bank accounts.
4. Establish in-house expertise to support ERP functionality through training MEPCO management and staff, and develop new applications.
5. Obtain insurance coverage for buildings, equipment, inventories, and such other assets as deemed necessary to eliminate exposure to significant financial loss.
6. Purchase a ten year financial forecast model for MEPCO, with appropriate training, for business planning purposes.

MEPCO appears to suffer from a lack of reliable access to long term capital. Because of its financial and wholly owned government status, banks are reluctant to lend significant amounts unless ordered to do so by the government. In the face of such risks, it is no surprise that MEPCO's only source of large scale financing capital is the government. Often the proceeds of loans by the World Bank or ADB, such government financing is not reliable or predictable, nor is its availability dependent on the financial strength of the DISCO itself, thus reducing the requirement for internal fiscal discipline. The shortage of reliable, reasonably priced investment capital has a significant impact throughout the organization, reducing the emphasis on long range planning, in favor of make-do arrangements. Such dependence on government financing must end if the utility is to be able to reliably carry out its obligations to its consumers, and function as a true corporate entity.

4.4. COMMERCIAL MANAGEMENT

Commercial policies are defined in a logical fashion, but are not effectively practiced. Moreover, these policies and procedures have not kept pace with changes in technology; rather than using electronic data collection and transfer, MEPCO relies on manual recording, transcription, and data transfer processes. They need to be changed at the earliest possible date by electronic data collection and processing, reducing potential for manual adjustments and interventions that results in loss of commercial integrity.

The meter reading practices currently employed are subject to influence by the operations department. Given that the goals of network operations and management are distinct from the goals of the commercial department, there is a need to realign the reporting requirements and oversight of the commercial staff.

As mentioned in the opening remarks of this chapter, there is an urgent need to introduce more modern, advanced technology into MEPCO's commercial management. Use of automated meter reading (AMR) meters; prepayment metering technology; handheld meter reading technology, and other advanced communication and metering technology would eliminate reading and transcription errors, and reduce vulnerability to meter employee and consumer manipulation of metering data. Use of AMR meters for industrial clients and transformers would make energy accounting more readily available, and would support work planning and analysis of the distribution infrastructure.

4.4.1. ADEQUACY OF ERROR DETECTION PRACTICES

The line superintendent, the reading section supervisor and the SDO are required by the *Commercial Procedures* to check a prescribed number of meter readings and bills delivered to ensure that "losses are brought down to a bare minimum and bills are delivered to the consumers." The XEN is also charged to physically check site readings and distribution of bills. The SE is required not only to check readings, but also review the meter reading auditing checks by the SDO and XEN. MEPCO management and staff readily stated that these practices are not followed as required by MEPCO policy.

Without an objective and periodic review of meter reader performance, meter reading personnel can (and reportedly do) manipulate consumption data for the purpose of increased revenues by taking advantage of the slab tariff structure. Over a period of a few months the readings can be corrected to actual, but the revenue is not adjusted for the over-billing. Because auditing procedures are not followed, collusion between employees and selected consumers will not be detected.

Since the billing software has been turned over to DISCO management, transaction audits have been discontinued. These audits are designed to identify changes to the consumer database, such as consumer status and tariff class changes. Changes are audited against authorizing documentation that is required to authorize changes. Without transaction audits, DISCO staff may make changes to the data base without fear of detection. Audits are common in most well-managed electric distribution utilities.

4.4.2. BILLING CYCLE AND ENERGY ACCOUNTING

Streamlining the billing cycle will result in financial benefits to MEPCO and/or CPPA. Improving billing cycle efficiency will result in accelerating collections, allowing MEPCO to generate short-term interest dividends, or to allow CPPA to reduce interest and penalty charges that may accrue from delays in payment to generation companies.

MEPCO's billing, collection and financial transfer procedures are common business practices for a manual system that could made more be effective for recording transactions if followed. Adding new technology and revising the procedures for the additions would streamline the billing cycle and reduce errors. Employees with jobs in billing and collection should be directly engaged in the design of new systems to ensure that meaningful changes are made to business processes, the new systems are readily accepted, and appropriate training and ongoing support requirements are fully understood.

The service territory for MEPCO is over 105,000 sq km. With no Level 1 revenue offices, all documentation must be transferred to the nearest Computer Center for processing. For some divisions, this is approximately

200 km away (e.g. Sadiqabad Division from Bahawalpur Center), delaying bill processing for the entire circle. The bills must then be returned to the revenue office for delivery; the due date may already have passed before the customer gets his bill.

Establishing a method to more accurately account for energy sales by feeder or distribution transformer would yield additional value, and could result in reduction of non-technical losses. Energy accounting could be accomplished by a number of methods. Use of AMR meters as revenue meters, or at delivery points would allow MEPCO to accurately monitor consumption via electronic, real-time means. Energy accounting could also be accomplished by using conventional electronic meters on distribution transformers, although this would be subject to the integrity of the meter reading process.

Energy accounting, if properly done, would highlight areas with the greatest losses. If subdivision management were to focus on areas where losses are highest, making a concerted effort to audit meter readings, this would support an effective loss reduction program. An effective energy accounting initiative would not only result in lower administrative losses, it could also result in higher billings leading to more income for the DISCO.

4.4.3. IMPROVED CONSUMER SERVICE

Although attempts are being made to improve consumer service, the programs have not yet proven to be significantly effective. Communication with consumers has been very limited. To report a supply failure, telephone numbers of the XEN and SDO are printed on the consumer bill; there is no number for billing complaints. Moreover, complaint resolutions have lagged, given that DISCO consumer service personnel are not always available, or perhaps do not make sufficient efforts to clear consumer complaints. Without question, a more aggressive program will be required.

Subdivision personnel assigned consumer service duties are also assigned other duties, attending to complaint resolution part time. Depending upon the nature of the complaint, the consumer service/complaint center personnel have limited authority to clear complaints, necessitating the consumer's repeated visits to the center to resolve issues that may arise.

4.4.4. RECOMMENDATIONS

In order to achieve improved commercial performance, a number of interrelated interventions will be required. Improvements in metering technology from electro-mechanical meters to electronic meters will have little effect for example, unless organizational and procedural changes are made in the meter reading auditing process to detect fraud or manipulation of the data. Implementation of a CIS will require new accounting, data collection and transfer, and billing procedures. Best practices require that a consumer census be taken to populate the CIS database with accurate information.

The following recommendations, if implemented in systematic and coordinated fashion, will result in increased revenue recovery, improved commercial efficiency, and enhanced consumer service:

1. Consumer census to verify/add consumers.
2. Installation of a CIS.
3. Reorganization of corporate structure so that all commercial units report to the Director Consumer Services.
4. Update metering, using AMR technology where appropriate, and evaluate use of meters on selected distribution transformers.
5. Reorganize meter routes.
6. Implement energy accounting.
7. Design more comprehensive customer service and consumer awareness programs.

8. Enforce meter reading audits and meter inspection program.

9. Establish systematic meter verification, repair, testing, and calibration programs.

4.5. HUMAN RESOURCES

HR policies and procedures have remained static for the past two to three decades and do not support MEPCO's current needs to attract and retain highly skilled, dedicated and engaged employees. Staff at almost all levels has repeatedly stressed the need for change and intervention in this area. While some capital investment will be required, the team feels that substantial investment in time is essential.

While there is much work needed to design and define new human resource policies and procedures responsive to MEPCO's requirements, changing the existing policies and procedures will require a modest investment of time and funds in comparison to other, more capital intensive efforts. These changes, if accepted and implemented, will require a substantial buy-in from MEPCO management and staff. Some of the changes will be back-office in scope, such as redefining post descriptions, a comprehensive compensation study, and hiring & advancement policies. Others will require a high degree of retraining, communication with management and staff, and some fundamental changes in corporate culture.

The principal changes necessary concern the compensation package, the recruitment and promotion program, and the performance management strategy. As mentioned in the previous chapter, the fundamental changes will need to occur in redefining job descriptions, position requirements, lines of authority, and other related factors. Concurrently with an upward adjustment in the salary structure, there will likely be a need to sustain staff reductions through outsourcing and attrition. Significant reductions will be required to bring MEPCO in line with best practices, but this issue will require and receive significant additional analysis and discussion before final decisions are made.

Increasing salary levels to bring these at par with market levels will not by itself change the work ethic and culture. There will be a need to actively engage in a new relationship with MEPCO management and board priorities; whereby employees are aware of, appreciate and accept the new corporate culture, and where good performance becomes a clear criterion for recognition and reward.

4.5.1. RECOMMENDATIONS:

1. Develop performance management program, together with revised job descriptions, setting goals and objectives for all staff positions; and establish mid-year and annual evaluation review process, measuring employee performance, and rewarding employees based upon performance.

2. Modify the recruiting policy to ensure an objective, transparent and unbiased recruitment process.

3. Revise the compensation and benefits system and package, making it attractive and competitive; a detailed market study will be required to devise the new package, and to select an effective methodology for its introduction to MEPCO personnel. For instance, the new higher package may be offered only to those employees opting for the new performance-based terms and conditions of employment.

4. Develop training and development culture & programs, and upgrade current training facilities (Regional and Circle Training Centers). This will have the effect of making training attractive to and more highly valued by employees.

5. Introduce more advanced information technology for use in human resource management (HRIS), as well as in training facilities.

6. Review and revise MEPCO's benefit plan, including the employee health plan to increase flexibility and choice of health care providers and facilities. Evaluate the introduction of a health care insurance policy.

7. Evaluate staffing levels vis-à-vis international best practices. Develop staffing plan to reduce levels in conjunction with outsourcing and reduction through attrition program. A review of the total workforce shows that a large number of employees are in non-core functions; areas which could easily be outsourced.

8. Establish a robust lineman safety program that provides structure, incentives, and discipline for all linemen employees. Ensure that linemen are provided and required to use proper clothing and safety gear while performing construction and maintenance tasks. It will be the MEPCO's social responsibility to effectively extend this safety message, through an outreach program, to its personnel and public alike.

9. Evaluate the housing allowances for employees residing in rural areas to attract the best resources for these areas.

4.6. COMMUNICATIONS AND OUTREACH

With limited in-house autonomy and capacities for devising and implementing a comprehensive communication and outreach system, MEPCO is currently facing countless challenges. The company needs to revamp the existing system and improve the efficiency of its internal & external communications to develop a progressive relationship with its stakeholders. To this end, the following recommendations are proposed:

1. Develop a comprehensive communications strategy for managing both internal and external communications.

2. Develop a Manual for corporate communication and promotion of a coherent, independent service delivery entity.

3. Empower and strengthen the PR Department to spearhead change in internal communication practices and undertake widespread consumer outreach activities.

4. Prepare and implement a plan to promote information technology oriented correspondence, record keeping, and information management.

5. Develop an Annual Calendar of outreach activities for consumer awareness and corporate brand building. Integrate consumer outreach activities with corporate issues of theft control and energy conservation through seminars, public dialogue, press shows, radio talk shows, collaborative events etc.

6. Develop a plan to upgrade Customer Centers with a corporate and consumer-friendly interface and a gender-centric dimension.

7. Upgrade the web page into an interactive web portal for better consumer outreach.

APPENDIX: AUDIT METHODOLOGY

A.1 Overview of Data Collection and Process Assessment

The Operational PDIP Audit process was designed to facilitate data collection and to evaluate engineering, financial, commercial & human resource information and data in collaboration with DISCO management. The objective of this activity was to evaluate performance efficiency by means of performance and process analyses, and by collecting information through one-on-one interviews with DISCO management and employees. The PDIP team thus not only collected data, but also reviewed and evaluated management practices and processes. For example, a key performance process for all electric distribution utilities involved the commercial cycle – the means by which meters are read, bills processed and delivered, revenues collected, and delinquency notices delivered. For a program which aims to measure commercial, financial, administrative and technical performance, review of key processes like the revenue collection cycle is extremely important.

The Operational Audit for MEPCO followed an identical process to audits undertaken at the other seven DISCOs. The process collected and evaluated data for four areas of electric distribution operations, including:

1. DISCO governance
2. Organizational review
3. Engineering
4. Financial management
5. Commercial management
6. Human resource management

Comparison of performance indices for a particular utility with those of highly functioning electric distribution utilities highlighted the functional areas requiring improvement, while comparison of best practices allowed the PDIP team to identify high impact performance interventions.

A.2 Governance

In addition to reviewing DISCO operational activities, the PDIP team reviewed the its governing board policies, procedures, and practices. With increased government emphasis on providing a governance structure with a higher degree of operational independence to the DISCOs, it was essential to evaluate the changes needed to better support board performance: composition, qualifications, training and other characteristics.

Towards this end, the PDIP team reviewed & analysed the following Board documents and actions:

1. DISCO by-laws that establish board selection processes, scope of authority, and overall responsibilities.
2. Board policy and procedures manual, if available.

3. Board composition, focusing on the issues of ensuring independent governance and adequate local representation.
4. Board Member appointment process, terms & tenure, and process of removal (if warranted).
5. Board Membership qualification requirements.
6. Training/orientation provisions for new Board Members.
7. Periodicity of Board meetings, and provisions for extraordinary meetings.
8. Fee structure – are Board Members reasonably compensated for their participation?

The purpose of this review was to present an analysis of the changes required to improve board composition, functionality, and preparedness to undertake DISCO governance.

A.3 Organizational Assessment

The PDIP team reviewed the management and organizational structure of each DISCO with the goal of assessing the efficacy of the institutional capacity to effectively manage its human resources, physical assets, and business systems based upon the organizational structure. The review included an evaluation of the following organizational issues:

1. Analysis of organizational design & structure.
2. Review of DISCO departments and divisions.
3. Review of key managerial positions and position descriptions.
4. Assessment of managerial and functional competencies.
5. Review of organizational chart, and recommended revisions.

A.4 Engineering Operational Audit

The engineering assessment reviewed four components:

- Transmission issues.
- Distribution system management.
- Segregation of technical and commercial losses.
- Distribution standards.

A.4.1 Transmission Review

The transmission review consisted mainly of an evaluation of the contribution of transmission losses to overall system losses. In the event that transmission losses did not constitute a significant component of overall system loss, the evaluation was truncated. In most cases, the transmission networks of the DISCOs are quite robust and are not a source of problems; therefore this segment of the evaluation is very limited.

A.4.2 Distribution System Management

Evaluation of distribution system management consisted of a series of interviews with staff from the Planning and Design, Construction, Operations, and Procurement Departments. During these interviews the DISCO staff responded to the team's questions and provided insight into the technical operations of the utility. These interviews were inevitably colored by the attitudes of the interviewees, as well as the misunderstandings of the interviewers, and should be taken as indicative rather than absolute truth.

Typical questions explored by the engineering team included:

- Status and currency of system maps.
- Processes used for distribution system planning.
- Methods for procurement; adequacy and availability of materials.
- Adherence to standards in construction documented by visual review of quality of construction.
- Meter security and vulnerability to tampering.
- Established & current operations policies, practices, procedures and adherence thereto.
- Adequacy of lineman safety programs and equipment.

A.4.3 Segregation of System Losses

The third component involved a mapping exercise and power-flow assessment in which the team attempted to use a sampling technique to segregate distribution losses between technical and commercial, and between the various components of technical loss. The team selected 11kV feeders that are, in the aggregate, representative of all the DISCO's feeders and therefore indicative of the level of technical loss of the entire company. An even smaller subset of low voltage (LT) networks were surveyed in detail with the objective of identifying the contribution of LT systems to the DISCO corporate technical losses.

In preparation for this portion of the task, the team reviewed transmission and distribution-system performance data to the extent available. Data in the review included:

1. Power delivered to each feeder by month for FY 2010 (July-June).
2. Commercial sales data by feeder, as available for each month of FY 2010.
3. Length of 11 kV feeders and laterals – by substation, as available.
4. Engineering standards, including standard conductor size for all voltage levels, & maximum circuit lengths for medium voltage (11 kV) and low voltage (400 volt) distribution circuits.
5. Standard for service entrance, meter installation for each customer category.

The engineering team then selected a group of feeders from the record that, as a whole, represented the principle characteristics of the DISCO; that is, sales distribution between domestic, commercial and industrial consumers, as well as average feeder length.

Each DISCO has up to, and in some cases over, 1000 11kV feeders, so it is necessary to establish sampling criteria as follows:

- Feeders were selected by a random number process so that each feeder had as much chance of being selected as any other, to enhance the potential that the set of feeders was truly representative of the system as a whole.
- Average feeder length of sample population was close to the average feeder length of the overall feeder population.
- Distribution of sales in kWh/year between domestic, commercial, industrial, agricultural and other consumers for the population of sample feeders was close to that of the overall DISCO feeder population.

- The sample feeders had complete data, including total sales and feeder input data, & total length. Feeders with data anomalies were excluded.

- Total feeder length was limited to 200km, which is the length of line that the PDIP GIS team could survey in the time period allocated.

Once the 11kV feeders were chosen, a total of upto six LT networks were chosen for detailed analysis. Because data is limited for LT networks, it was necessary only to specify that the LT networks chosen be fed by the selected feeders. To the extent possible, they were chosen randomly from the set of general service distribution transformers on the selected feeders.

11kV Feeder Mapping and Analysis

Once selected the 11kV feeders were mapped using a rapid GIS technique that identifies only corner and intersection poles, and poles with equipment installed on them. Observable data such as conductor size, transformer capacity, and transformer status whether general service or dedicated, was noted manually and transferred to an attribute database.

Once the circuit was mapped, the information was transferred to a Milsoft Windmil model. This is a standard distribution analysis software used widely in the US and Latin America. Windmil can model single or three phase loads, 60Hz or 50Hz systems, and accepts user information on all conductors and transformer characteristics not in the default database. The majority of the conductors used at 11kV by the DISCO are Osprey and Dog, with some Panther and Rabbit, all of which are ACSR conductors. LT conductors are mainly Wasp and Ant, which are all aluminum conductors. Characteristics for these conductors was obtained from tables and incorporated into the database. Similarly, the DISCOs use a common specification that specifies transformers with maximum allowable levels of losses, a legacy of WAPDA procurement practices. The maximum allowable levels of loss have recently been changed, but none of the new units have been supplied yet. Transformer characteristics used in the model therefore correspond to legacy DISCO transformer values of no-load and load losses, as shown in the table below:

KVA Rating	10	15	25	50	100	200	400	630
Impedance	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Core Loss (W)	65	85	123	175	310	495	925	1350
Load Loss (W)	320	435	640	1170	2020	3410	5600	8150

It should be noted that these are the values specified in the WAPDA transformer specification DDS-84 for prototype transformers. The standard allows a +15% tolerance in the individual no-load and load loss values of individual production units, and a +10% tolerance in total losses. No attempt was made to incorporate these tolerances into the model, so it is likely that transformer losses are in reality slightly higher than those indicated.

While Milsoft can accept data on location-linked consumer loading, the time available for this project did not permit data on actual loading to be used in the model. Instead, the feeder peak load was obtained from substation records, and this known load allocated among the various transformers on the basis of transformer capacity, i.e. a transformer of 200kVA was allocated twice as much of the actual feeder demand as a 100kVA transformer.

Another matter that is important is the level of power factor to be used in the model. Substation meters record kWh and kVARH, from which power factor could be calculated, however only circuit amperes and kWh readings are actually recorded by the substation operators. The engineering team obtained station log sheets from the period around the feeder peak. Estimated average hourly power factor was then computed by calculating kVA using logged amperes, and an assumed bus voltage of 11.5kV and the differences between the hourly kWh meter readings, to estimate kW.

Once the model, loading, and power factor were established the feeder power flow analysis was carried out. Losses were then developed for conductors and transformers on each feeder. Owing to the assumption that the sample feeders represent the system as a whole, the percentage losses attributable to conductor and transformers are assumed to apply not only to the sample feeders but to the entire system.

LT Network Mapping and Analysis

Because not all the LT networks on a particular feeder can be mapped, the process of mapping for the LT networks differed from that used for the 11kV feeders. For the LT networks, the mapping included a consumer census of all the consumers fed by the LT network. In addition, a meter reader accompanied the survey team, carrying with him the meter read route book from June 2010, the month of assumed peak demand. It was therefore possible to obtain and record in the GIS database for the LT network the metered consumption for each consumer.

Since the majority of the consumers located on the LT networks are billed by kWh consumption only, it was necessary to convert the kWh data to demand (kW) for modeling. As no measurements of actual demand were available, it was necessary to estimate demand using only the average energy consumption of the consumers. In order to determine the peak demand in kW likely from consumers on each LT network during the month of June, the data on consumption was applied to the demand equation below. This equation was derived many years ago by the Rural Electrification Administration (REA) in the United States, and has been verified by NRECA as acceptably accurate for use in developing countries as well. The equation is as follows:

$D = N*(1-.4N+(N^2+40)^{0.5})\ 0.005925*C^{0.885}$

Where:

D= Monthly peak demand in kW for a particular group of consumers

N= Number of consumers in the group

C= Average monthly consumption per consumer in kWh/mo.

The demand value calculated by the equation was applied as the source demand for the particular LT network, at a power factor of 80%, and the demand allocated to the segments of the LT network in proportion to the kWh of the consumers connected to that segment. Losses computed from the model therefore correspond to the losses in the LT network conductors.

It was necessary to generalize these results so that they could be applied to all general use transformers on all the modeled feeders, so as to obtain a system value for LT losses. A value of average loss in watts per kVA of transformer capacity was developed for this purpose.

Service Drop Losses

Service drop losses can be calculated on the basis of the assumption that all domestic sales used single phase meters, while all commercial and direct reading industrial sales used three phase meters. In most DISCOs, an effort was made at some point in the past to move meters to the base of the pole as opposed to being mounted on the exterior of the residence. This had the effect of shortening the effective length of the service drop from the utility's standpoint, to something less than 10 meters. Examination of the system indicates that this process has not been completed in many urban areas, and the meters are still located on the exterior of the buildings. For this reason, the average service drop length has been assumed to be 12 meters. The table below indicates the assumptions for the three types of consumer.

CHARACTERISTICS OF SERVICE CONDUCTOR				
Consumer Type	Service Wire	Cores	Service Type	Length M
Domestic	7 x 0.052	Two	1 Ph	12
Commercial	7 x 0.052	Four	3 Ph	12
Industrial	19 x 0.052	Four	3 Ph	12
Agricultural	19 x 0.083	Four	3 Ph	12

Average service loading was determined using the REA equation described above to calculate the total demand of the consumers of each class on each of the modeled feeders. Knowing the number of consumers of each type on the feeder allowed for an average demand per consumer to be calculated. Three phase loads were assumed to be balanced.

Calculation of Energy Losses

Once the components of demand loss were calculated, it was necessary to convert the values derived from demand loss on peak to average energy loss. Because losses are a function of the square of load, it was necessary to account for the variation in load during the course of a year. The standard way in which this is handled is to determine a loss load factor based on the annual load factor of the system. The standard equation used in the US private utility industry is:

$$LLF = K(ALF)^2 + (1-K)(ALF)$$

Where:

LLF= Loss Load Factor, or the load factor of the on-peak losses.

ALF= Average annual load factor for the element under consideration.

K = a constant determined by analysis of the load curve of the feeder and recognizing that losses vary inversely as the square of load.

Annual load factor was computed for each feeder on the basis of the data supplied by the DISCO, and the loss load factor calculated according to the given equation. The factor "K" was determined by reviewing the substation log sheets for the two-week period around the system peak for the feeder, and determining the K factor by analysis The same feeder loss load factor was applied to all components of loss.

Once the components of energy loss for the sample were determined; consisting of conductor loss, transformer loss, LT network conductor loss, and service drop loss, it was possible to sum up all the components to determine the technical losses for the sample and thus for the system as a whole. Any difference between the stated distribution losses of the DISCO and the technical losses calculated by this method constituted an estimate of non-technical loss.

A4.4 Distribution Standards

The fourth and final component, which was applicable to all DISCOs but was reported only for LESCO, consisted of a series of interviews with staff at the Distribution Standards Group of the NTDC. This Group maintains the construction and design standards that are utilized by all DISCOs, as well as the technical specifications that govern all procurements. In addition, the team visited a single manufacturer of distribution transformers and meters in an effort to evaluate local resources for these important components.

A.5 Financial Management Audit

In the preparatory period prior to beginning the Operational Audits, key financial parameters were identified for inclusion in the data collection and analysis process. The financial performance parameters evaluated include: financial reporting, internal control, cash receipts and disbursements, operational financing, and investments and cost containment.

The financial management audit consisted of a combination of interviews, data collection, and analysis of key financial data. The interviews with senior DISCO management were conducted to gain an understanding of DISCO policies, procedures, and operating practices. From these discussions, the PDIP audit team identified operational objectives, expected financial and controls, and key areas of risk.

DISCO practices and procedures were evaluated for financial performance parameters. Variance between industry practice and DISCO performance were noted and reported. Procedures were used to test each financial control as a means of verifying the control mechanisms with the results documented in the DISCO assessment report.

The first Operational Audit undertaken at LESCO served as a vetting process for the above described plan. The financial management audit team worked as a single unit at LESCO to ensure that all team members gained the experience and understanding of the assessment process, and to adjust the audit process for later DISCO audit processes.

Once the LESCO audit began, the finance team met with the LESCO CFO to discuss the audit plan and determine with which DISCO officers the PDIP team members should coordinate to perform required tasks. Team members met at the end of each working day to discuss problems, make any necessary adjustments to the process, and schedule the plan for the next day.

Tools

The financial management team reviewed LESCO's organizational policies & procedures, annual report, and system of accounts; and held interviews with DISCO management and employee personnel. Templates were developed as data gathering tools to populate various financial models used for analysis. The financial management team coordinated with the commercial management team to ensure that information and data needed by both teams was shared and incorporated into the analysis and reporting process.

Analyses

Analyses included an evaluation of financial management processes, management of banking functions, management of cash and receivables, internal control processes, and overall management of DISCO financial performance. Results of these analyses were presented in the form of data tables, performance ratios, and discussions of specific issues that did not lend themselves to objective numeric presentation.

Presentation of Results

- Analysis of cash receipts and disbursements
- Operational financing
- Internal control
- Cost containment
- Financial reporting with financial performance indicators

A.6 Commercial Management Audit

The focus of the commercial management audit was on the revenue cycle which included the registration of new consumers, meter reading practices, bill production and delivery, and the receipt of consumer payment information. Other activities such as the disconnection and reconnection process, bill adjustment procedures, and customer services were also reviewed. These examinations were made so as to identify opportunities to increase the efficiency and transparency of commercial activities, and improve the financial performance of the DISCOs . Opportunities to improve financial performance included revisions to current procedures with technological enhancements, or replacement of the billing system with a CIS to better manage customer information with records of all customer interactions in addition to preparing bills. The commercial assessment team consisted of international and Pakistani consultants with practical work experience of one or more electric distribution companies, and in-depth understanding of utility commercial practices and procedures.

Data Collection

Procedural data was collected through interviews and observations. The overall commercial process was ascertained from the Commercial Director. He was given the opportunity to discuss specific problem areas and activities deemed crucial to the revenue process. Procedural details for each activity and the time required were obtained from the in-charge department heads. These procedures were verified by observing the actual practices at selected Revenue and District Offices and pay points.

The commercial team also collected billing/collection/consumer data from the billing system. Not only did this data serve as a baseline reference to gauge future results, but was also used to provide an indication of the time taken to complete the revenue cycle. Other hard data collected during the interviews included number of meter reading routes, actual number of meters in a route, frequency of meter tests and calibration, customer billing complaints, and number of employees involved in the revenue cycle.

Strategic Analysis

Once the data collection process was complete, the commercial management team members evaluated the data and DISCO commercial practices to determine what changes were needed to improve transparency, cost recovery, and effectiveness of the commercial procedures & practices. Each step and stage of the revenue process was mapped indicating the flow of documentation, when approvals were obtained, decision points for corrective action, and the interaction between departments. These maps were reviewed for redundancies and possible internal control weakness such as lack of separation or coordination of different duties/activities. The maps were studied to determine if there was a more efficient flow of data or where interventions would be helpful in reducing costs, increasing revenues, and/or accelerating cash flows.

The interventions included a combination of investments in secondary distribution systems, transformers, services, and revenue meters; as well as changes in commercial system practices and procedures to improve DISCO metering and revenue recovery practices. The procedural changes required the addition of devices to eliminate transcription errors, accelerate data entry, and increase internal controls. The Commercial Specialist also evaluated and made recommendations regarding the effectiveness and adequacy of commercial software (the CIS), with the aim of determining if a software solution that more effectively integrates commercial, accounting, human resource, work order, and other DISCO functions was merited.

A.7 Human Resource Management Audit

An integral part of the operational audits included an evaluation of human resource management and HR systems for each DISCO. The HR review evaluated DISCO organizational structure, analyzed performance management systems, evaluated compensation systems, reviewed selected management and staff positions, and performed a preliminary analysis of the training needs, specifically focusing on commercial needs and linemen training to improve productivity and safety. The HR audit was led by the Organizational Specialist, responsible for leading a team of Pakistani human resource and institutional management specialists.

The goal of the HR management audit was to identify improvements needed in DISCO organizational structure and human resource management, to result in an HR model supporting the long-term institutional needs of the DISCO. The model should establish appropriate levels of compensation and benefits, and provide a work environment conducive to motivated and capable employee performance. This model should also support a process-centric culture, and a cost delivery model appropriately balancing efficient customer service with effective service delivery. The DISCO organizational structure should support high quality electric service and high customer satisfaction, both of which are predicated on highly motivated and satisfied DISCO employees The assessment therefore focused on the HR organizational structure in which the HR functions operate, as well as the current roles of line managers and their staff managers.

The team reviewed and evaluated the state of the HR management system, functions, responsibilities, performance management systems, and compensation package. The evaluation compared the DISCO HR management systems with best practices from within and beyond Pakistan, from which recommendations were made regarding the improvement of policies, practices and procedures to enhance the productivity of each DISCO. The assessment team used diagnostic tools to identify gaps in optimal DISCO personnel performance. Data was collected through interviews and surveys to take a baseline of current policies and practices; this was contrasted with best practices to define the actions necessary, through the DISCO Performance Improvement Action Plans, to result in significantly enhanced HR policies, practices, and management systems.

Data gathering included:

1. Internal interviews with and surveys given to department managers and senior engineers.
2. Interviews with Chief Executives and senior management to evaluate the DISCO's vision, mission and strategic objectives.
3. Identification of major functional skills and competencies.
4. Surveys of staff from engineering, commercial management, system operations, and administration at the Division and Subdivision levels to evaluate roles and responsibilities, adherence to existing procedures including health and safety, and any other standard operating procedures existing within the DISCOs.

Review of HR strategic and functional analysis included:

1. Assessment of company's vision, mission, goal and objectives and their linkage with departmental goals and objectives
2. Assessment of recruitment process
3. Evaluation of compensation and benefits
4. Evaluation of performance management system
5. Evaluating the integration of corporate communications and HR communications

Evaluation of training and capacity building needs included:

1. Development of training needs assessment survey form.
2. Completion of training needs survey by distributing needs assessment forms to functional heads to determine critical skills & competencies gaps. The same will be translated into a launch of urgent training program in pilot project
3. Identification of essential and immediate training needs for engineering, financial management, commercial management, and human resource functions.

A.8 Communications and Outreach Audit

Communication and outreach is a direct expression of corporate culture and values of an organization. The key areas of communication as well as processes and tools employed to communicate, to a large extent, determine the corporate priorities for internal and external stakeholders. One of the major differentiating features of progressive organizations vis-a-vis status-quo driven organizations is practice of contemporary modes of communication, openness and scientific knowledge management for efficient and speedy decision-making for the larger good of the organization.

A communication and outreach assessment was conducted to have a diagnostic analysis of the state of internal and external communication and outreach. The analysis was intended to provide sufficient information to serve as a foundation for developing communication and outreach strategy leading to action plan, promoting better understanding and improved public opinion of the DISCO as an electricity distribution company.

The Communications Assessment included:

1. Review and analysis of existing internal and external communication and outreach strategy, organization chart of relevant departments and job descriptions of relevant staff.
2. Review of existing and previous communication and outreach campaigns, materials, media mix, budgets, communication briefs etc.
3. Visiting customer centers/ complaint centers to obtain first-hand information on ground communication with customers in terms of customer services and complaint handling style, clarity, processing time and delivery practices. The customer services and complaint handling were also reviewed with a gender perspective.
4. Review of internal communication process, feedback and follow-up status to assess the efficiency of internal communication.
5. Review of current state of information technology being used for external and internal communication.
6. Identifying training needs for relevant staff.
7. Assessing the current practice of various communication tools/vehicles eg. website, newsletters, emails, event management and other multilayered activities.

Drawing from the assessment results, the report describes various issues, and identifies areas where action would be worthwhile. It offers a series of recommendations for high priority communication-related activities that could enhance the DISCO's effectiveness in communications and outreach, upgrade the capacity of its communications-related staff, and enhance the efficiency of its communications department.

Ultimately, these proposals if effected should contribute towards the DISCO's development as a service-delivery and customer-centric corporate entity.

Internal Communication

Internal communication is related the communication within the DISCO; between individuals, different departments, or individual and department. The assessment mapped the internal communication process, feedback and follow up status to determine the existing system's suitability and efficiency.

External Communication and Outreach

The analysis of external communication evaluates the effectiveness and extent of activities carried out for corporate image building towards a liaison between the organization and its relevant stakeholders, including

widespread audiences. Promotion of a strong corporate culture and a coherent brand identity through an adequate budget and communications tools are areas deserving due attention.

Outreach activities for target groups of stakeholders are an extension of corporate communication to ensure sustained visibility and perception of a positive corporate image.

The following methodology was employed to review and analyze the communication and outreach process and existing strategies of the DISCO:

Key personnel interviews:

In-depth interviews with key DISCO personnel were conducted using a semi-structured questionnaire. The questions asked were geared towards developing an understanding of existing practices, modes and means, efficiency and speed of communication, & availability of and access to information. Issues relating to the practice of Information and Communication Technology (ICT) and knowledge management were likewise discussed. Deliberations also focused on strategic efforts to develop a corporate brand image with external stakeholders as a coherent communication strategy for the company. The existing outreach activities and their potential was similarly discussed.

Besides these interviews, questionnaires were filled in by relevant senior officers on the corporate, external and internal communication & outreach activities of the company.

Focus group discussion:

A focus group discussion was held with managerial staff of relevant departments to discuss cross-cutting issues of internal and external communication and contemporary communication culture, along the lines mentioned above, to ascertain feedback and comments from middle management level.

Documentary review:

Review and appraisal of relevant material available with the PR,, MIS and Customer Services Departments was undertaken, including: records of daily press cuttings, press releases, printing and publications; practices and process of data collection, bills printing and various output reports; and registers of customer complaints, to assess the efficiency of the current system.

Visit to the Customer Center:

The Customer Services Centre at the DISCO head office was visited to understand the complaint handling process and evaluate the level & quality of customer service.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov