PAKISTAN-US ENERGY PARTNERSHIP

GUJRANWALA ELECTRIC POWER COMPANY (GEPCO) OPERATIONAL AUDIT REPORT

Produced by:

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

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TABLE OF CONTENTS

EXECUTIVE SUMMARY **1**
Overview of the project 1
Major Findings & Conclusions 2
Key Recommendations 4
Strategic Directions 6
Critical Success Factors 7
How This Report is Organized 8

1. INTRODUCTION **10**
1.1 Overview 10
1.2 GEPCO Profile 12
1.3 Overview of PDIP Audit Methodology 16

2. RESULTS **17**
2.1 Governance 17
2.2. Engineering Review and Analysis 19
2.3 Financial 45
2.4 Commercial Management 56
2.5 Human Resources 83
2.6 Communications and Outreach Assessment 96

3. CONCLUSIONS **102**
3.1 Governance 102
3.2 Engineering 102
3.3 Financial Management 109
3.4 Commercial Management 111
3.5 Human Resource Management 114
3.6 Communications and Outreach 116

APPENDIX: AUDIT METHODOLOGY **117**
A.1 Overview of Data Collection and Process Assessment 117
A.2 Governance 118
A.3 Organizational Assessment 118
A.4 Engineering Operational Audit 119
A.5 Financial Management Audit 125
A.6 Commercial Management Audit 126
A.7 Human Resource Management Audit 128
A.8 Communications and Outreach Audit 129

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

kVAR – Kilovolt Ampere Reactive

kVAR – Kilovolt Ampere Reactive Hours

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

EXECUTIVE SUMMARY

Overview of the Project

Background

Pakistan's Power Sector has been beset by significant challenges for a number of years. 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 Gujranwala Electric Power Company (GEPCO), 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.

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. These improvement opportunities 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 projects to demonstrate a number of key operational improvements and directly measure their value to the utility.
- GEPCO has adequate investment through ADB Power Distribution Enhancement Investment Program (Tranche I & II) with major emphasis on transmission system expansion, up-gradation

and augmentation. Therefore, PDIP focus is mainly on distribution system (11kV and below) improvement as it lacked investment.

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Major Findings & Conclusions

The Operational Audit conducted for GEPCO during Component 1 provided extensive insights into how the utility operates, and the performance consequences of its current approaches and practices. The PDIP team also became acutely aware of deficiencies that obstruct progress toward improvement. Part of the challenge faced by GEPCO'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 audit's 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	GEPCO'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 the Government is a positive step toward greater professionalism and operating autonomy; however, additional changes will be required to enable the BOD 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	GEPCO'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 company. Overall organization structure needs review and further evaluation.
ENGINEERING	Construction and maintenance work practices in widespread use among GEPCO 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 significant financial impacts for the DISCO. Preliminary loss analysis on a sample of five feeders using GIS mapping and modeling technique with a load flow software shows that the technical

	losses were 4.9% against reported distribution losses of 10.2% for the year ended on June 30, 2010, leaving 5.3% as the administrative losses. Accordingly, a strategic opportunity exists for GEPCO to reduce its commercial losses and significantly improve its financial performance.
FINANCIAL	A number of manual processes resulted in poor financial reporting and negative comments by the auditors i.e. certain projects were not promptly capitalized, certain cash/bank reconciliations items were outstanding since 2006, receipts against deposit works were not reconciled on time, and there was no stores reconciliation of items capitalized/expensed/transferred etc. The AJK government's rate is determined by a Standing Sub Committee and differs from the NEPRA rate methodology calculation. The GEPCO collection rate for government client, 52.0%, is much lower than for private clients. GEPCO'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 company also shoulders certain cost burdens that are 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	Statistics indicate that GEPCO is functioning reasonably well. However, commercial activities need improvement and transparency. The meter reading practices currently employed are subject to influence by operations management. No substantial changes have been made to the commercial procedures implemented in the late 1980s. These procedures were designed for manual processes to feed a computerized billing and collection program that was state of the art at the time. The entire revenue cycle, from the setup of a new customer account to meter reading to receipt of customer payments and ultimate revenue recognition, remains highly fragmented with inadequate monitoring of all steps in the revenue cycle.
HUMAN RESOURCES	HR policies and procedures have remained stagnant for the past two to three decades, and do not support GEPCO's current needs to attract and retain highly skilled, dedicated and engaged employees. Although GEPCO is performing reasonably well, yet it has potential for further improvement that can be capitalized by providing regular training and capacity building of the existing human resource supported with motivation and incentive initiatives. The principal changes necessary concern the compensation package, the recruitment and promotion program, and the performance management program. These changes will require a redefinition of descriptions, post requirements, lines of authority, and other factors. There will also be the need for a high degree of retraining, communication with management & staff, and several fundamental changes in corporate culture.
COMMUNICATIONS & OUTREACH	GEPCO inherits the communications policies and practices of its predecessor organization, featuring rigid protocols of routine inter and intra departmental correspondence. Electronic modes of communication are not practiced, resulting in a communications system which is obsolete, time

	consuming and inefficient. GEPCO faces complex challenges in countering the frequent criticism from its end-consumer due to tariff increase and load-shedding – factors beyond its control. Its PR department is responsible only for local media coverage and public relations. Mass media campaigns are managed by PEPCO wherein GEPCO merely contributes its share as a partner DISCO. It has no role in the selection of subjects for mass media promotion, content development, choice of advertising agency, media mix, and frequency of media campaigns. Outreach activities are sporadic, occasional and ad hoc.

KEY RECOMMENDATIONS

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

GOVERNANCE	The recently reconstituted Board of Directors should be given authority to direct the affairs of GEPCO. The Board should be empowered to: 1. Set company policies, performance objectives and strategic directions. 2. Adopt bylaws. 3. Name members to its advisory, executive, finance, and other committees. 4. Hire, monitor, evaluate, and fire the CEO and senior executives.
ORGANIZATION	A thorough review of organizational structure should be undertaken to evaluate organizational changes required to improve GEPCO'S technical, commercial and overall operational performance. Organization of the utility along functional lines; 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 routine operational management to qualified senior managers.
ENGINEERING	The Operational Audit produced a large number of specific recommendations in the areas of loss reduction, mapping and planning, high tension, low tension, and metering. These are detailed in the Recommendations section of this report. One key recommendation promising to improve many areas of engineering performance is to develop a geographic information system (GIS) for the entire GEPCO service territory; and to link the GIS with engineering software to develop long-term system planning capability. This would allow the company to perform detailed short- and long-term work plans identifying loss reduction targets, and to expand service capacity where and when necessary.
FINANCIAL	GEPCO's greatest financial vulnerability centers on its relationship with government clients. Given the unlikelihood of its securing 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 the utility and should include: 1. Updated accounting and internal audit procedures that more effectively serve the needs of the BOD. 2. Complete implementation of the ERP platform, and expand its applications to serve all financial & accounting needs in line with control, management, and financial reporting to the GEPCO 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. 3. A dual reporting role for the IA Department : (1) to the CEO for facilitating direction, support and administrative interface; (2) to the BOD Audit Committee for assisting strategic direction, reinforcement and accountability. 4. Improved transfers from external pay points to GEPCO bank accounts. 5. Insurance coverage for buildings, equipment, inventories and other assets as deemed necessary, to eliminate exposure to significant financial loss.
COMMERCIAL	In order to improve the commercial management of GEPCO, its commercial practices and procedures need to be updated, and implemented with discipline and integrity. Without carefully designed and integrated procedures, including a system of evaluation and monitoring, an effective and transparent system cannot evolve and financial viability will be at risk. The following recommendations, if implemented in a 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 Customer Information System (CIS). 3. Reorganization of corporate structure so that all commercial units report to the Director Consumer Services. 4. Update metering, using advanced metering technology where appropriate (AMR), 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 checking, testing, and replacement.
HUMAN RESOURCES	GEPCO management should strive to create a corporate environment and employment conditions that enable *all* employees to:

	1. Understand the corporate Vision Mission and Goals. 2. Have clear and specific roles and responsibilities in the organization and recognition of the value of their contribution to the corporate success. 3. Be empowered with the appropriate level of authority needed to manage assigned tasks. 4. Have access to the equipment, support, knowledge and training needed to succeed. 5. Be fairly compensated for their work, with adequate benefits. 6. Feel engaged with their position and consider the company their institutional home.
COMMUNICATIONS & OUTREACH	In order to improve communications, outreach, PR and corporate image GEPCO needs to: 1. Develop a comprehensive Communications Strategy to transform internal and external communications, using modern communication technology. The strategy should include an action plan, with allocation of resources and implementation timeframe. 2. Develop a corporate Branding Manual for promoting an independent and progressive brand image for the company. 3. Strengthen the Public Relations Department to undertake comprehensive external communications and outreach activities to position GEPCO as a progressive corporate entity. 4. Prepare and implement a plan to promote ICT-enabled correspondence, records keeping and information management, as per its internal corporate communications strategy. 5. Develop an Annual Calendar of outreach activities for consumer awareness, focusing on the issues of theft control, energy conservation etc. 6. Develop a plan to upgrade Customer Complaint Centers with ICT-enabled technology, a trained staff in CS communications skills and a display of information material e.g. posters & brochures for efficient customer service. 7. Upgrade the web page into an interactive web portal, and establish a web-based intranet to improve both external and internal communications.

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 GEPCO faces today, it lays bare what is wrong and what should be considered by GEPCO management to fix it. 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.

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 GEPCO, 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 the 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 a strategic 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.

Benchmarking to Measure Progress

GEPCO 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 & 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.

CRITICAL SUCCESS FACTORS

Numerous barriers stand in the way of GEPCO improving its operating performance and becoming financially self-sufficient. These 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 GEPCO, and overcoming them will be critical to success.

Appropriate Use of Technology

GEPCO'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 GEPCO 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 that are being adopted by leading utilities elsewhere. Employees are not accustomed to learning new systems and adapting their workflows to take full advantage of technology. Familiarity with computers, local area networks (LANs), and common desktop software is severely limited; and procedures accompanying technology-enabled business processes e.g. backups & system modifications to insure their robustness likewise 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 GEPCO'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.

Fostering a Corporate Culture that Embraces Change

Obviously, setting a course for the future does not necessarily ensure that the destination will be reached, or reached safely. In GEPCO's case, nothing short of a dramatic change in corporate culture will be needed. As noted, 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 too small to receive specific attention. Empowering GEPCO'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 GEPCO 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 change to employees 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.

HOW THIS REPORT IS ORGANIZED

The main body of this report is organized to highlight current challenges GEPCO 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 GEPCO 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.

1. INTRODUCTION

1.1. 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 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.

1.1.1 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. 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.

1.1.2 PURPOSE OF OPERATIONAL AUDIT AND IMPROVEMENT ACTION PLAN

The objective of the GEPCO 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 GEPCO 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 GEPCO's Performance Improvement Action Plan.

1.2 GEPCO PROFILE

The Gujranwala Electric Power Company (GEPCO) is a wholly-owned government distribution company with headquarters located in the city of Gujranwala, a major industrial city of Pakistan. GEPCO is responsible for supply of power to six (6) districts of the Punjab province namely Gujranwala, Hafizabad, Mandi Bahauddin, Gujrat, Sialkot and Narowal. It has boundaries adjoining LESCO, FESCO and IESCO. The territory is spread over about 17,207 sq. km.

Fig. 1a: Location of DISCOs

Source: NEPRA Status of Industry Report 2009

Fig. 1b: GEPCO area map

Source: Wikipedia Website February 2011

GEPCO has 4 Circles, 23 Operation Divisions and 116 Subdivisions to manage its operations. Circles are headed by Superintending Engineers (SEs), Divisions are managed by Executive Engineers (XENs), and Subdivisions are run by Sub Divisional Officers (SDOs). Each division has a Customer Services Officer (CSO).

TABLE 1.1: GEPCO CHARACTERISTICS

No	Description	Value
1	Administrative Districts Served	6
2	Service Area (km^2)	17,207
3.	Operation Circles	4
4	Operation Divisions	23
5	Operation Sub-divisions	116

General description of market

As of 30th June 2010, GEPCO reported over 2.4 million registered customers. Approximately 86% of its total customers are domestic. The other predominant category is commercial, comprising more than 11% of customers. The industrial and agricultural customers account for 2% and 1.4% of all customers served, respectively.

TABLE 1.2: GEPCO CUSTOMER DISTRIBUTION AS OF 30TH JUNE 2010			
No.	**Customer Class**	**Customers**	**Customer Mix %**
1.	Domestic	2,098,682	85.50
2.	Commercial	270,701	11.03
3.	Industrial	49,778	2.03
4.	Bulk Supply	132	0.01
5.	Tube wells	34,495	1.41
6.	Other	466	0.02
	Total	**2,454,254**	**100.00**

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

Reported sales by customer class vary widely from the distribution of consumers. GEPCO's primary clientele is domestic consumers, accounting for about 56% of sales while commercial and industrial consumers amount to about 6.5% and 26.8% of sales' shares respectively. The portion of sales to bulk supply consumers accounted for 4%, while the contribution of agricultural consumers (tubewells) was about 6.6%. Table 1.3 provides a summary of sales by customer class.

TABLE 1.3: GEPCO SALES FOR 2009-10			
No.	**Customer Class**	**Sales GWH**	**Proportion %**
1.	Domestic	3,475	55.88
2.	Commercial	407	6.54
3.	Industrial	1,666	26.78
4.	Bulk Supply	252	4.05
5.	Tube wells	411	6.61
6.	Other	9	0.14
	Total	**6,220**	**100.00**

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

Statistical summary, comparison with other DISCOs

Some significant performance indicators for GEPCO are shown in Fig. 1.4. Its transmission and distribution losses reported as slightly above 11% are the 2nd lowest amongst all DISCOs. Power distribution losses of other DISCOs range between 11% -37%.

Transformers' failure ratio at GEPCO (2.5%) was moderate compared to that for other DISCOs, ranging between 1.6% - 4.04%.

TABLE 1.4: GEPCO 2010 KEY PERFORMANCE INDICATORS		
No	**Description**	**Value**
1.	Transmission & Distribution Losses	11.1%
2.	Outages	
	Number of Outages	50,860
	Total Outage Time (hrs)	34,034
	Hours per Outage	0.669
3.	Transformer Failure (% MVA)	2.5%

GEPCO serves about 12.5% of the electricity distribution market in Pakistan in terms of number of customers, sharing 9.8% of total energy sold while contributing 8.9% to the total revenue collected. Its HT and LT network is about 7% and 8% of the country's total length of HT and LT lines. Its transformer capacity is 9% of the total capacity of all DISCOs, slightly less than its share in number of customers. GEPCO is responsible for about 9% of the allocated load, but slightly less share in the total non-coincident peak demand, of all the DISCOs.

TABLE 1.5: GEPCO FY 2010 STATISTICS			
Description	**All DISCOS***	**GEPCO**	**Share (%)**
Customers	19,582,224	2,454,254	12.53
Sanctioned Load (MW)	47,855	4,831	10.10
Non-Coincident Peak Demand (MW)	19,288	1,813	9.40
Energy Sales (GWh)	63,660	6,220	9.77
Employees	122,530	13,703	11.18
Revenue (Million Rs)			
- Billed to Customers	488,022	48,137	9.86
- Collected from Customers	517,055	46,085	8.91
Receivables from Customers			
- Private	103,351	5,322	5.15
- Government	58,026	868	1.50
Total	161,377	6,190	3.84
Distribution Network			
- HT Line (km)	279,990	19,786	7.07
- LT Line (km)	205,020	16,726	8.16
- Dist Trans Capacity (MVA)	32,524	2,996	9.21

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

GEPCO as a whole statistically appears to be a relatively good performer. Its revenue collection was around 96% of the billing (other DISCOs range between 60%-97% with 47 day's billing to customers in arrears (other DISCOs range between 32-60 Days). Its human resource was 11% of all the DISCOs. In the fiscal year 2009-10, the utility earned a net profit of about Rs. 4.146 billion. Further improvement in its performance would reduce the subsidy burden on the national exchequer.

The purpose of this report is to explore GEPCO's operating practices and procedures, to identify where it should be able to make improvements in these; ,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.

1.3 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 GEPCO 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 GEPCO 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.

2. RESULTS

2.1 GOVERNANCE

2.1.1 OVERVIEW

The PDIP team evaluated the structure and activities of the Board of Directors of GEPCO, to evaluate how the Board is organized and gage the level of authority it exercises. 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 the MWP, and were recently reconstituted with the appointment of public, private and academic Members, so many of the PDIP observations stated below may not be germane in future months. However in the interests of identifying potential improvement opportunities, findings of the review will be presented here nonetheless.

2.1.2 SUMMARY OF KEY FINDINGS

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

- GEPCO'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 minutes indicates that matters considered are largely routine; and there is scant evidence of its taking up any strategic issues.
- Declaring its intention to reduce the influence of the government in DISCO governance and move them towards greater operating independence, MWP recently dissolved the GEPCO Board, appointing a new one in its place.
- Guidelines for the reconstitution of the new Board appear to provide a better mix of professionals and stakeholders.

2.1.3 ANALYSIS & 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 GEPCO BOD consisted of seven members, including the CEO. Because the company is wholly owned by the government, MWP appoints all public directors and PEPCO appoints all private directors according to a formula as follows:

- Four members from the public sector, including the CEO of the utility.

- Three members from the private sector, of which one will be the Chairman.

The Memorandum and Articles of Association require two 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 the state of affairs of the DISCO. This meeting is preparatory in nature to gear Members for the annual general meeting of shareholders which must take place within four months of fiscal year end. The Board has not developed any policies specific to the governance of an electric utility in general, or to GEPCO in particular, relying on the requirements of the Companies Ordinance 1984 and the company's Articles of Association.

The GEPCO BOD has chosen to voluntarily govern itself informally under the Code of Corporate Governance, a set of governing standards for listed companies. These standards are more stringent, and as a result the Board meets on a monthly basis to ensure that "important company business can be reviewed and executed in timely fashion, and keep up-to-date with important issues pertaining to GEPCO operation". However as noted earlier, its deliberations cannot be considered substantive. Review of minutes, above, 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 performance evaluation of the CEO is the primary Board function on most corporations, but GEPCO's CEO who is also a member of the BOD is appointed by MWP through PEPCO.
- The company's entire senior executive cadre is PEPCO- appointed rather than selected or recruited by GEPCO.
- Members nominated from government agencies were senior in position, and therefore in age resulting in short tenures and high turnover.

In an effort to understand just what powers the BOD actually has, the Book of Financial Powers (BFP) was reviewed and discussed with the Board's Secretary, who is also GEPCO's Deputy Manager Transport. 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 GEPCO management and Board in the operation of routine activities. GEPCO's BOD monitors the adequacies of these authorities and limits for operational efficiency. Should BFP changes be necessary, the BOD takes the necessary actions to revise it without reference to PEPCO? However it was the conclusion of the PDIP team that GEPCO's BOD had relatively little authority over GEPCO management and could not be considered a true corporate board.

As mentioned, by MWP's notification of 22 November 2010 all DISCOs, GENCOs, and NTDC BODs were dissolved towards their reconstitution "on professional lines" as per Cabinet Committee on Reforms guidelines, prioritizing consumer representation. Significant results include:

The new boards were announced February 7. Many of the private sector representatives were members of the respective boards before dissolution. GEPCO's new board consists of six members from the private sector, one academic, a retired Chief Engineer of GEPCO, a former federal secretary, the JS (Power) MWP, a representative from the Cabinet Committee on Reforms, a member of the Privatization Commission Board and the company's CEO. The Board's total strength is 13 Members. The new DISCO Boards are charged to carry forward the reorganization of the public sector companies and run on commercial lines.

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 their establishment 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, as well as training 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, in addition to acting as an authority on any proposed new positions at the DISCO. This was a role PEPCO assumed during the nascent phase of DISCO formation and never relinquished. The utilities must be able to manage their own manpower requirements.

The Internal Audit Department was reporting to the CEO instead of to the Board Audit Committee. PEPCO has sent instructions to all DISCOS in July 2010 to change this reporting hierarchy to the Board Audit Committee. IA wanted these instructions to be implemented in true spirit once the new Boards are in place.

2.1. ENGINEERING REVIEW AND ANALYSIS

2.1.1. 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.

Gujranwala Electric Power Company Ltd. (GEPCO) is a Public Limited Company incorporated in May 1998 as an Electricity Distribution Company with jurisdiction in the Punjab province. It serves a total of about 2.5 million consumers, with an annual growth of 4.1 %. It services the urban as well as rural areas through 4 operation circles, 23 divisions and 116 subdivisions with almost 19,786 km of 11kV distribution line, 16,726 km of LT lines, 1,669 km of 132kV and 335 km of 66kV transmission lines through 52 grid/substations. Peak demand for FY2009-10 was 1,813 MW and purchases were 6,987 GWh, with aggregate Transmission & Distribution losses of 11.1 %.

Approximately 56% of GEPCO consumers are domestic, while 7 % are classified as agricultural, and approximately 31 % as industrial including bulk customers through 11 kV distribution network.

2.1.2. SUMMARY OF KEY FINDINGS

Transmission System Management: The following are key findings of the PDIP review of GEPCO's engineering operations in the area of transmission system management:

- **Network—**GEPCO's transmission network, while moderately loaded and in need of upgrading, is robust and appears to provide adequate service. It is not likely to be a significant contributor to total system loss.
- **Losses—** While transmission losses are not significant, they would likely be lowered through modeling and analysis efforts. Loss levels in the distribution system are also higher than need be, and will require efforts to reduce non-technical losses to achieve the desired reduction.

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 GEPCO. 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**— Feeder mapping is not carried out on a systematic basis. Each subdivision has its own single line diagram of feeders, but no geographic maps exist anywhere in the company. The Planning Department sends its surveyor to track the feeder, using the odometer on his motorcycle and other estimating means to assess length as and when need arises. The resulting track, along with conductor and transformer size information, is hand drawn on taped together pieces of paper. Distribution circuits are hand plotted on paper copies of Survey of Pakistan quadrangle maps to perform area planning manually. Feeder bifurcations or connections from newly commissioned grid stations are generally decided this way.

- **Feeder analysis software—**The software used by GEPCO for feeder analysis is outdated and lacks 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.
- **National design standards—**Current national design standards do not adequately address congested area construction, and this is a problem in some urban areas serviced by GEPCO.
- **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 GEPCO 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 GEPCO.
- **Meter security**—Meter security was found to be compromised by both the ease with which meter installations can be tampered with and equally vulnerable service drops. Meter installations in rural areas were especially problematic.
- **Procurement**—GEPCO 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. GEPCO is procuring an unusually large amount of materials this year due to heavy flood damage sustained in Southern Punjab.

Distribution feeder mapping and loss segregation: Here are 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 GEPCO's system should be approximately 4.9% of annual energy (kWh) which is very close to benchmark.
- GEPCO reported total system energy losses of 11.1% in the 2009-10 fiscal year. If transmission losses were 0.9% as reported by GEPCO/NTDC, the distribution component of loss was 10.2%. The difference between the distribution technical loss of 4.9% and the total distribution loss 10.2% is a non-technical loss of 5.3%.
- This figure is likely to reflect meter tampering, illegal line taps, and meter reading fraud aided and abetted by company employees.
- **Accordingly, a strategic opportunity exists for GEPCO to reduce its commercial losses and significantly improve its financial performance.**

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 Gujranwala, Gujrat and Sialkot, focus was given only to replacing HT conductor with higher capacity and bifurcation of feeders. No activity is underway to evaluate any other changes required in standards for this purpose.

2.1.3. ANALYSIS & DISCUSSION

The engineering assessment of GEPCO consisted of three components. The first is an evaluation of transmission issues. The transmission system at this utility 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 GEPCO 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 GEPCO'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 GEPCO corporate technical losses.

Transmission System Management Assessment

Initial visits indicated that the transmission system, while moderately loaded, and no doubt in need of improvement, was providing adequate service. GEPCO has a transmission network totaling 1,669 km of 132kV and 335 66kV line, receiving power from NTDC. There are a total of 52 grid substations. System peak demand is 1,814 MW, a figure that is somewhat suppressed by load shedding. As noted, this is a robust transmission network, and while it probably has issues of its own, is unlikely to be one of the significant contributors to system losses.

GEPCO 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. The 6th STG plan is in its final completion whereas the 7th STG plan, based on Asian Development Bank & Korean (EDCF) loans, has been submitted for approval. Under this plan, eleven new grid stations will be constructed and six 66kV grids will be converted to 132kV.

Total system losses in GEPCO during FY2009-10 were 11.1%, as reported to NEPRA. A review of the data provided to the team on 11kV feeders indicates that distribution loss was 10.2%, leaving 0.9% for transmission loss. A preliminary estimate of transmission losses using estimated values and a simple model of the system yields a likely transmission loss of 2.7%, including loss in grid substation transformers. It was felt by the company's strategic planning unit that a problem exists with metering in the transmission network, potentially either at the NTDC delivery points or at GEPCO substations. Metering systems at both points are manually read at different times, and both utility 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 no compelling evidence that transmission issues were contributing negatively to the financial performance of GEPCO, and it was decided early in the assessment to focus effort on distribution issues, which were clearly more demanding.

2.1.4. DISTRIBUTION SYSTEM MANAGEMENT ASSESSMENT

Planning and Design

Planning and design of distribution lines are carried out in the same department under the direction of a Chief Engineer of 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 GEPCO is not adequately staffed to conduct the planning studies needed to develop load forecasts, to model the transmission and distribution system on a holistic basis, or to develop medium and long-term investment plans. Distribution planning has traditionally been carried out in response to identified problems, but more efforts are underway toward system expansion especially on LT networks, under funds allocated to legislators for their areas. During FY 2009-10, the Planning Department carried out an exercise in identifying high loss feeders on a quantum basis, as opposed to percentage basis. The results were delivered to M/S Barqab to prepare rehabilitation/bifurcation proposals to be reviewed and approved by the Planning Department and given to the Project Director Construction for execution. In FY 2009-10, 256 work orders were issued for HT/LT rehabilitation amounting to Rs. 195.59 million whereas Rs. 353.55 million was invested on village electrification projects. Comments on the various components of utility planning are as follows:

Load Forecasting

A five year load forecast is prepared; however NTDC determines growth rates for each customer class and provides this information to GEPCO. No overt efforts at collection of load forecasting

data, such as population growth, demographics, or historical sales data is carried out by GEPCO. Data on sales by consumer class is supplied to NTDC, but the process is prescriptive once the growth factors have been received. GEPCO 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 an in-house engineering planning responsibility.

Mapping

Feeder mapping is not carried out on a systematic basis. Each subdivision has its own single line diagram of feeders, but geographic maps are not maintained anywhere in the company. When a feeder enters into an overload situation, defined as exceeding a peak load of 300 amps, or the operating subdivision suspects that a distribution transformer is overloaded, it advises the Planning Department. This department sends its surveyor to track the feeder, using the odometer on his motorcycle and other estimating means to assess length. The resulting track, along with conductor and transformer size information is hand drawn on taped together pieces of paper. The information provided by this map is then used as input to the analysis program. Once the issue that brought the feeder or the transformer to the attention of the Planning department is resolved, the project is archived and no effort is made to maintain or update the feeder information.

Distribution circuits are hand plotted on paper copies of Survey of Pakistan quadrangle maps to perform area planning manually. Feeder bifurcations or connections from newly commissioned grid stations are generally decided this way.

Establishment of a new grid substation is a more complex issue, in that many feeders must be mapped and many analyses done, but the outcome is essentially the same, i.e. no attempt is made to update the feeder information that is collected during the course of the project or to maintain any sort of map database.

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 calculating 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 outdated 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 software's limitations 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 GEPCO, 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. Due to the complexity of the software and lack of resources it could not be used for distribution planning. What is needed is an intermediate solution that addresses the shortcomings of FDRANA while still being simple to use and low in cost.

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 GEPCO, many customers have paid for installation of dedicated transformers ranging in size from 25kVA to 630kVA. In the vast majority of cases these dedicated 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 at 11kV) so should provide considerable capacity. In actuality, the majority of GEPCO's 11kV 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 GEPCO system is very congested in cities, especially in Gujranwala, Sialkot and Gujrat, and the national design standards adequately address the challenges they face. One area which GEPCO has not pursued, and which could have an effect on their operations is the use of multiplex or aerial bundled cable (ABC) LT line. It would definitely assist the company to reduce the possibility of unauthorized hooking or "kunda connections".

Construction

The mission of the Project Department at GEPCO 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 utility's service area, either by its own staff or through local contractors. The projects undertaken by the department fall into three categories:

- Those funded from GEPCO's budget for distribution upgrading and loss reduction.
- Those included in the Power Distribution Enhancement Investment Program funded by the ADB (mainly meter upgrades).
- Deposit work paid for by others, such as line relocation required by road widening and village electrification.

Village electrification, which amounts to more than 55 % of GEPCO's construction activity, is considered deposit work due to its mode of implementation. 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/Provincial Assembly identifies an area he/she desires electrified, and obtains the funding/allocation from the national/local government for the project according to rapport with the ruling party/current govt. According to the rules governing these types of projects, GEPCO can include in the budget 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. Members of the national assembly, depending on their influence or relationship with the government party, have allocations they can use to demand construction of projects.

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 (eg.bolts, or D-irons), 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 and village electrifications which are contracted out to local contractors. For ELR jobs, M/S Barqab prepares planning proposals and estimates and verifies BOQ of the field work. The Project Division is self inspecting, i.e. there are no independent construction inspectors as such. As noted, 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 GEPCO 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 the shortage of line staff including Linemen and Assistant Linemen. Construction staff mostly remain in the unit as they may forfeit seniority/timely promotion if transferred to Operations. The field staff undergoes training only when inducted and promoted. No regular or construction specific training programs are conducted.

Operations and Maintenance

The fundamental organizational unit for GEPCO operations is the subdivision. There are 113 subdivisions in GEPCO, each serving approximately 22,000 consumers. They are defined geographically by feeder service areas and are grouped into divisions, with approximately five subdivisions per division for a total of 23 operations divisions. Divisions are grouped into circles with approximately four to five divisions per circle. GEPCO has a total of 4 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 Meters 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 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 was populated by old materials 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.

The PDIP 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 these 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, because the aluminum conductor 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 health of the energy meters being used in the field were deplorable. Similarly, the use by utilities 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 the condition and installation quality of meters replete with multiple opportunities and invitation for tampering: tilting, open terminal covers, even open joints that cannot be considered secure or even safe for the general public despite being in active service. The following picture describes the typical installation witnessed by the PDIP engineering team in Gujrat and Gujranwala cities:

Illegal connections are difficult to isolate from this jumble which is commonly seen, in addition to posing safety hazards best illustrated by the following pictures:

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 and 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 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. The approximate distribution of causes 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. PDIP's engineering team visited a construction site and witnessed the quality of safety measures being observed by the line staff, with open safety belt hanging in, and trying to rest on the tower arm which is evident from the following pictures:

GEPCO is having difficulty convincing assistant linemen to transition to full climbing linemen, and it is true that most of the linemen observed by the team to be climbing poles were senior.

The PDIP team observes that issues affecting lineman safety in electric utilities are not unique to GEPCO 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 GEPCO 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 GEPCO 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 GEPCO staff but needs further examination.
- Poor work planning procedures that do not consider safety a primary 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 employees that knowingly violate safety procedures and by their example encourage others to do so.

Most of these issues are within the control of management, and should be addressed aggressively and definitively.

Meter Security

GEPCO has not undertaken a large scale campaign to replace electromechanical meters with electronic units; approximately 95% of meters remain electromechanical. This means that meter vulnerabilities at the utility are the same as they have always been, that attempts by consumers to disable meters by tilting, dirtying, or otherwise stopping the meter disc continue, and there is as well the 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 common risk with A-base meters.

It is generally considered that the aforesaid vulnerabilities are also an issue, and observations indicated that most meters were not properly attached to the building or bracket and were not upright and clean. Bottom connections on the meters were not covered or sealed, and the company does not have a routine meter testing program, so older meters are likely to be slow. The inspection of the meter fleet indicates that meters are generally not secure and still constitute vulnerability.

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 produced in Pakistan 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 (WB), ADB 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.

2.2.1 DISTRIBUTION FEEDER MAPPING AND LOSS SEGREGATION ANALYSIS

As discussed in the Methodology section, the segregation of technical and non technical losses for the GEPCO distribution system will be based on power flow models of a sample of its feeders. The process calls for selection of feeders on the basis of a consistent sampling method, mapping the feeders using a simplified geographic information system (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.

Selection of Feeders

According to data provided during its annual business plan presentation in October 2010, GEPCO has 510 11kV feeders, totaling 20,121 km of line. Average feeder length is approximately 39 km. 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 sampling 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 GEPCO 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 GEPCO 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. The utility's 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:

- GEPCO provided data on a total of 510 feeders.
- 13 feeders show losses less than or equal to 0 %, whereas 136 feeders show losses ranging from 0 to 1 %.
- A total of 29 feeders showed losses between 20% and 30%, whereas 41 feeders showed losses in excess of 30% and less than 50%. 112 feeders showed losses between 50% to 100%, and 6 feeders showed losses above 100%. In summary, 27% of the feeders show losses less than 1 % against 23% having losses more than 50%.
- A total of 17 feeders lacked data on length.

The anomalies in the data appear to be due to a slow process for updating feeder information. Feeders that show either 0% 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. A total of five feeders emanating from four 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 2.1 below:

Table 2.1 Feeder data.

Feeder Name	Length	Demand	Sales MWH				
	km	Amps	Domestic	Commercial	Industrial	Agricultural	Other
BOEKEY (IRRI)	59.7	185	5,330	397	340	652	0
GHARI AWAN(HFD-2)	16.1	350	269	46	19,737	0	0
MODEL TOWN	9.8	288	466	86	14,590	36	1
CIRCULAR ROAD	10.5	247	11,995	1,041	1,753	83	34
SHABIR SHARIF SHAHEED	24.1	144	6,613	794	1,986	221	2
Sample Average	24.0		37.1%	3.6%	57.8%	1.5%	0.1%
GEPCO Average	**39.0**		**55.1%**	**6.6%**	**31.0%**	**7.1%**	**0.2%**

Table 2.1 above shows the sales for the sample of feeders chosen for mapping. The length of the feeders chosen for mapping averages 24 km, compared with an average length of 39 km for the system as a whole. The sales breakdown between consumer types for the sample urban feeders is close to that of the system as a whole.

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 this 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 were obtained from tables and incorporated into the database. Similarly, GEPCO 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 transformer values of no-load and load losses, as shown in table 2.2 below:

Table 2.2 Transformer characteristics

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 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 2.3 below for the sample feeders.

Table 2.3 Feeder power factor

Feeder Name	Power Factor	Power

	At Max Load %	Factor at Min Load %
BOEKEY (IRRI)	73%	71%
GHARI AWAN(HFD-2)	94%	100%
MODEL TOWN	82%	64%
CIRCULAR ROAD	100%	100%
SHABIR SHARIF SHAHEED	100%	100%

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 2.4 below shows the results, disaggregated by line (conductor) loss, and transformer no load and load loss.

Table 2.4 Modeled line and transformer losses

Feeder Name	Length km	Peak Demand kW	Line Loss kW	Transformer Loss	
				No-Load kW	Load Loss kW
BOEKEY (IRRI)	59.69	2,819	201.7	21.0	51.6
GHARI AWAN(HFD-2)	16.14	5,339	171.7	39.0	59.6
MODEL TOWN	9.79	4,391	104.5	32.1	44.9
CIRCULAR ROAD	10.5	3,764	35.6	23.4	53.3
SHABIR SHARIF SHAHEED	24.1	2,194	83.4	22.8	50.4

While these results illustrate the line and transformer losses of the feeders, it is also 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 of 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 2.5 below:

Table 2.5 LT losses

Feeder Name	U/R	LT Length	Transformer Size	LT Source Load	Source p.f.	Total Losses	
		(km)	kVA	kW	(%)	kW	W/kVA
Boekey_SC1	R	0.438	200	92	84	0.77	3.85
Boekey_SC2	R	1.31	200	84	84	14.3	71.5
Ghari Awan_SC1	U	0.487	200	69	82.1	1.048	5.24
Ghari Awan_SC2	U	0.488	200	94	82.1	0.97	4.85
Model Town_SC1	U	0.463	200	99	81.5	1.718	8.59
Model Town_SC2	U	0.5	200	165	81.5	5.975	29.875
Circular Road_SC1	U	0.31	100	101	81	6.76	67.6
Shabir Sharif Shaheed_SC1	U	1.82	200	124	82	8.63	43.15
					Average All Lt		26.78

The results of the LT analysis show that LT losses vary from 0.84% to 17.02% of the power delivered by the transformer. Average loss for the LT network is 26.78 Watts/kVA. The lengths of both urban and rural LT networks were in the order of 727 meters per transformer, although one of those sampled was only 310 meters. Loading for this group of transformers varied from loads of no more than 42% of capacity to 101% of capacity. Of the transformers chosen, only the one overloaded transformer exceeded just 1% of its capacity in June 2010. No attempt was made to assess balance, but it is clear that only a relatively few of GEPCO'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, to obtain a value for LT losses. A value of average loss of 11.6 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 more uniformity for the rural transformers.

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 premise. 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 2.6 below indicates the assumptions for the three types of consumer.

TABLE 2.6 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.

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 GEPCO 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 GEPCO, 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 2.7 below:

Table 2.7 Summarized loss analysis

Feeder Type	Conductor Loss %	Transformer Loss %	LT Network Loss %	Service Drop Loss %	Annual Energy Loss %
Total Sample	**1.5%**	**2.2%**	**0.9%**	**0.3%**	**4.9%**

As noted above, GEPCO had actual distribution system losses of 10.2% in the 2009-10 fiscal year. The difference between the distribution technical loss of 4.9% and the total distribution loss 10.2% is a non-technical loss of 5.3%.

Validation

GEPCO's report to MWP of June, 2010 reported Transmission and Distribution losses of 11.1%. This is only slightly at variance with the results 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, which is MWh sale 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 GEPCO, results in the Table 2.8:

TABLE 2.8 GEPCO BENCHMARKED LOSSES

HT & LT Km	Sales Density MWh/Km	Benchmark Technical Loss %	Actual Distribution Loss %
38,905	159.9	6.8%	10.2%

It is apparent that according to this benchmark, GEPCO should have a distribution loss of approximately 6.8%, a value which is in close agreement with the assessment of technical losses presented in this report.

Possible Technical Opportunities for Reduction of Non-technical Loss

While GEPCO technical losses are remarkably low, there exist opportunities to reduce non-technical losses to result in higher overall revenues. Potential opportunities are as follows:

- Mapping GEPCO HT and LT circuits using a GIS would provide key 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 95% of GEPCO 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 the company 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 help minimize errors, and assist in identifying 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 much cheaper and more reliable than bolted connections.

2.3 FINANCIAL

2.3.1 OVERVIEW

The financial management operational audit was designed to evaluate the effectiveness and efficiency of financial management at GEPCO. The audit process has been designed to evaluate operational control against standards set by management. Factors included in the process include long term plans, budgets, and operating policies & procedures. The financial information presented in this report, except for the data provided in Table 1.5, is supported by the June 30, 2010 audited financial statements. The financial information presented in Table 1.5 was compiled by PEPCO from separate documentation submitted by DISCOs.

2.3.2 SUMMARY OF KEY FINDINGS

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

Cash Receipts and Disbursements:

- As noted, GEPCO's collection rate for government clients 52% is much lower than it is for private clients 93%. GOP accounting regulations prohibit making provision for past due receivables from government clients, and therefore the utility must consider all government receivables collectible.
- GEPCO 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 are paid from the company's distribution margin. These taxes represent a significant financial burden.

Financing and Investments:

- In 2008 four DISCOs, including GEPCO, were asked by GOP to obtain loans to pay for government shortfalls in power costs incurred by all DISCOs. GEPCO was required to absorb a portion of the interest expense incurred on these loans.
- Though it has revenues of Rs. 58 billion ($US 696 million) per year (as per Audited Financial Statements FYE 2010), the utility budgeted just $39 million for system investment in 2009-10. This level of investment is insufficient to maintain its distribution infrastructure over the long term.

Internal Controls:

- Internal Audit only functions as a financial control in the review and certification of certain consumer electricity billings and financial transactions. Moreover, the external auditor is unable to rely on the work of Internal Audit due to the department's lack of independence and professional competence. The existing Audit Manual does not address the specific audit procedures required to perform internal auditing procedures as the organization has evolved and new system processes introduced.
- The department reports directly to the CEO; it has no reporting relationship with the BOD.

- In the financial auditor's most recent letter to the BOD, it was observed there was a need to conduct training courses on a regular basis to increase the knowledge and proficiency of internal audit staff.

Cost Containment:

- GEPCO's vehicle fleet consists of a total of 600 vehicles, approximately one third of which are 20 years old or older. The company's fleet management policy requires vehicle replacement when every ten years, but vehicles are rarely replaced on schedule due to conflicting approval policies. Even if the company were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy allowing vehicle replacement. Not surprisingly, older vehicle maintenance costs are significant.
- GEPCO is currently paying PEPCO approximately Rs 12.5 million per year as a software license fee for three applications (billing, payroll and inventories). This expense would be eliminated and may help fund the migration to ERP.
- GEPCO has significant financial vulnerability due to lack of insurance on its facilities. Grid stations and certain new vehicles are presently the only facilities covered.

Financial Reporting:

- The current accounting system is unable to meet the growing needs of GEPCO, an entity that employs geographically disbursed cost/revenue centers. There is extreme complexity in the number and type of transactions and data flowing between the various regions and headquarters. In addition, there are numerous offices requiring an integrated information system solution. Currently, the organization has no documented IT strategy to guide either the ERP or other IT initiatives into a coordinated and planned implementation of business systems solutions.
- GEPCO continues to use an archaic WAPDA Accounting Manual now increasingly obsolete owing to changes in accounting practices in Pakistan.

Financial Performance:

- Maintenance expense as a percentage of operating revenue indicates that GEPCO is spending significantly less 0.98%, than are US rural electric cooperatives 7.98%, to maintain its electric system. However this is partly explained by the fact that GEPCO has invested a significantly smaller amount 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 GEPCO has significantly more operating revenue remaining after power costs to support its existing plant through operations and maintenance expense (3.1) when compared to the US cooperatives (6.3). A smaller plant revenue ratio indicates higher revenue per unit of investments in plant. The US cooperatives have invested significantly more in total plant per kilometer of line Rs. 2,622,327, than has GEPCO Rs. 1,128,948.
- The amount of trade debt receivables over 60 days as a percentage of operating revenue is somewhat higher for GEPCO, 0.93%; than for the US cooperatives, 0.23%. This comparison is based upon FY 2010 GEPCO trade debt.
- The US rural electric cooperatives' consumer density averages 8 consumers per kilometer, while GEPCO has 111 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while GEPCO's consumer to employee ratio is 201 to 1. Even though GEPCO is above 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 the utility able to achieve a consumer to employee ratio close to 467:1, its savings would approach Rs. 1.7 billion per year.

2.3.3 ANALYSIS & DISCUSSION

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

Cash Receipts and Disbursements

GEPCO receives cash from various pay points including banks, post offices, and NADRA with methods of payment including cash, online banking, and credit cards. All payment collection centers are required to transfer funds collected (net of collection fees) to the respective GEPCO central bank account. The company receives 75% of its deposits the same day in its bank account; NADRA payments, 15% of total deposits, are received within one day after customer payments have been made. The remaining 10% of deposits, received from post offices, take approximately two days to be transferred to the GEPCO primary bank account. The utility then makes periodic payments from central bank accounts to PEPCO/CPPA after deducting 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 GEPCO account on a timely basis.

It was noted by the Finance Director that on occasion PEPCO requests cash from GEPCO 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 through on a monthly basis. The loss of time it takes to recover excess capacity charges is a cost in the loss of cash flows.

GEPCO Annual Reports show significant trade debt receivables. The company makes provision for doubtful trade debt accounts aged three years or more. The cumulative provision at FYE 2010 was Rs. 130,091,162 or approximately 1.7% of the total. Generally, GEPCO's accumulated provisions for past due accounts receivables are determined to be uncollectable, and it makes no further attempt to collect them. Alternatively, it could consider engaging a collection agency to make further

attempts vis a vis these accounts, paying a percentage of the collected total towards achieving the targets, paid on a contingency basis.

In fiscal years 2009 and 2010, the trade debts written off were Rs. 6,879,942 and Rs. 1,271,053, 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 provision 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, GEPCO was somewhat higher at 0.9% as compared to the US rural electric cooperatives at 0.23%.

GEPCO receivables from government accounts equal Rs. 1,195,269,824. Approximately Rs. 723 million is attributed to the AJK government, whose rate is determined by a Standing Sub Committee and will differ from the NEPRA rate methodology calculation. The GEPCO collection rate for government clients is much lower than it is for private clients; the collection rate for government clients is 52.0%, while GEPCO has a collection rate for private clients of 93.9%. GEPCO does not make provisions for uncollected government accounts; GOP accounting regulations prohibit making provision for past due receivables from government clients and the DISCO 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.

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

- General sales tax (GST) assessed at 17% on domestic consumers and export industries.
- 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 tax paid from the DISCO's distribution margin may represent a significant burden for those utilities with low collection rates. These taxes are netted against GST credits arising from purchases. . GEPCO had a net GST receivable of Rs. 562,125,052 at FY 2010.

Financing and Investments

Electric utilities are capital intensive operations, requiring a regular and dependable stream of long term financing at reasonable rates to be able to undertake system improvements when prudent and necessary. GEPCO'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 WB, or ADB lending, but in reality these funds are actually provided by the banks to GOP who on-lends them to the DISCO. Subject to the geopolitics of government and multilateral bank relations, such financing is not related to the financial strength or the particular needs of the utility; the funds are always project specific and cannot be relied upon to be available when needed by the DISCO.

Local banks are not enthusiastic about extending long-term credit to the DISCOs, since as government entities they are subject to political requirements not always aligned with the DISCO's individual financial sustainability. For instance in 2008 four DISCOs, which included GEPCO, were asked to obtain loans to pay for government shortfalls in power costs which were incurred by all DISCOs. GEPCO's share of the borrowings was Rs. 8.62 billion. A portion of its interest on these loans was reimbursed by the GOP. In 2009, GOP incorporated a new company namely Power Holding (Private) Limited (PHL) with the sole objective of holding term finance certificates issued to the power distribution and transmission companies managed by PEPCO. PHL has assumed or will assume the obligations created by the TFCs upon final approval by the lending banks.

Cash flow generated by operations is satisfactory only for meeting short term needs, making the GEPCO 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 GEPCO has revenues of Rs. 58 billion ($US 696 million) per year (as per Audited Financial Statements FYE 2010), it could only reliably undertake about $39 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. 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. GEPCO's rate of return on rate base may range from 13%-17%.

Internal Control

The team visited the main regional warehouse site location and reviewed policies, procedures and operations. The GEPCO 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 one regional warehouse and 8 field warehouses. The GEPCO Annual Financial Audit included no observations with regard to shortages in distribution and transmission stores. During our discussions and observations the following strengths were noted in warehouse operations:

1. Facilities guarded by competent, private security firm.
2. Timely and regular reconciliations.
3. Employee training.
4. Competent personnel.
5. Appropriate segregation between purchasing and stores functions.

It was noted that the value of slow moving and obsolete items accounted for less than 1% of the total inventory amount. While the Board of Directors has the authority to approve/write off amounts, action will not 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. The BFP establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by GEPCO management and Board in the operation of daily activities. The Book was reviewed and discussed with the Secretary of the Board, who is also GEPCO's Deputy Manager Transport. The BOD monitors the adequacies of the above approvals and limits for operational efficiency. Should BFP changes be necessary, the BOD will take the necessary actions to revise it without reference to PEPCO.

In a review of the Internal Audit (IA) Department, it was determined that IA operations employ approximately 168 people out of a total of 201 sanctioned posts. The department continues to employ the WAPDA Audit Manual dated August 1985. In addition to this, it 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 states that it "has to 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, internal audit functions only as a limited review of certain transaction based activities, rather than as a full review of internal control systems. Also, as noted above, IA reports directly to the CEO with no reporting responsibility to the BOD. The existing Audit Manual does not address the specific audit procedures that will be required to perform internal auditing procedures in an ERP environment.

In support of the above observations the following recommendations were included in the financial auditor's most recent letter to the BOD:

> We recommend that, in order to establish an effective and independent internal audit function:
>
> - The head of the Internal Audit Department should report to the Audit and Finance Committee.
> - Scope and annual audit plan of the IA Department should be formally approved by the Audit Committee.
> - Internal audit reports should be finalised and issued in a timely and efficient manner.
> - Management should also conduct training courses on a regular basis in order to increase the knowledge of internal audit staff.

This same letter highlighted the need for IT to establish certain backup and secure storage, business continuity, and disaster planning for GEPCO operations.

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 services for software and other services that are not cost competitive with private sector sources. The application of this

requirement is not uniform across all DISCOs, so opportunities for savings may vary from one to the other.

In the case of GEPCO, vehicle fleet maintenance costs were discussed with the Deputy Manager Transport. The vehicle fleet comprises a total of approximately 600 vehicles; generally one third of the vehicles being 0-10 years old, one third 10-20 years, and one third over 20 years. The utility's fleet management policy requires vehicle replacement every ten years, while the private sector practice usually requires replacement after five years; this occurs due to a ban on new vehicle purchase established by PEPCO.

With a high number of very old vehicles, maintenance costs are significant. Despite GEPCO's ten year replacement policy, it is not strictly followed. Even if GEPCO were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy which would allow for a replacement of a vehicle.

It was noted that the company had significant vulnerability due to lack of insurance on its facilities. Grid stations and certain new vehicles are the only facilities covered.

GEPCO is currently paying PEPCO approximately Rs 12,500,000 per year as a software license fee for three applications (billing, payroll, and inventories). These payments could be eliminated, and the above license and maintenance fees possibly reduced, with the migration to ERP.

Financial Reporting

Similar to other DISCOs, GEPCO is using PITC, a PEPCO company, to provide billing, payroll and inventory management applications to run its operations. In addition, GEPCO has internally developed a Human Resource management system as well as a limited information system. It was noted that these internally developed systems require significant resources. There was consistent management feedback that the organization should be moving toward an ERP solution. System applications include:

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 database functions
2. Payroll
3. Self service
4. Recruitment
5. Expense management

The benefits include:

1. Better control at all levels.
2. Ability to facilitate day-to-day management reporting.
3. Provision of immediate access to enterprise information.
4. Integration of various business functions.
5. Production of more accurate information
6. Improved financial management and corporate governance.

GEPCO's Information Technology Manager has plans to educate management and the BOD on the needs and potential of an ERP solution. A meeting with the Board had been scheduled prior to its dissolution.

A recent comment in the auditor's letter to the BOD relates directly to the utility's financial reporting activities and its need for improved systems:

> "..Company does not have a documented IT strategy which should define the its course of action to achieve its business objectives relating to IT in line with its business strategy as a Company."

A Customer Relationship Management System, similar to MS Sharepoint, is being included in future development to allow customer service representatives and other personnel access to certain customer records, and provide for an enhanced customer service experience.

A number of manual processes resulted in poor financial reporting and negative audit observations such as projects not being promptly capitalized, cash and bank reconciliations outstanding since 2006,

receipts against deposit works not effected on schedule, and no stores' reconciliation to items capitalized, expensed, transferred, etc.

GEPCO continues to use an archaic WAPDA Accounting Manual now increasingly obsolete owing to changes in accounting practices in Pakistan. The GEPCO Finance Director is in the process of updating the manual.

Financial Performance Indicators

Financial performance indicators provide a means of measuring distribution utility performance as a comparison to 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, 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 3 million consumers.

Maintenance expense as a percentage of operating revenue indicates that GEPCO is spending significantly less than US rural electric cooperatives to maintain its electric system, 0.98% for GEPCO compared to 7.98% for rural electric cooperatives. However, this is somewhat explained by the fact that GEPCO has invested a significantly smaller amount in total utility plant per kilometer of line than US rural cooperatives. The plant revenue ratio (total utility plant/operating revenue less cost of power) indicates GEPCO has significantly more operating revenue remaining after power costs to support its existing plant through operations and maintenance expense when compared to rural electric cooperatives, 3.1 for GEPCO and 6.3 for rural electric cooperatives. The rural electric cooperatives have invested significantly more in total plant per kilometer of line than GEPCO, Rs 2,622,327 for rural electric cooperatives and Rs 1,128,948 for GEPCO.

Given the very low consumer density per kilometer of line, the level of line losses for US rural 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.

For the FY 2010 the amount of trade debt receivables over 60 days as a percentage of operating revenue is slightly higher for GEPCO than for US electric cooperatives: GEPCOs trade debt to operating revenue ratio is 0.9%, while the US electric cooperative average is 0.23%.

US electric cooperative consumer density averages 8 consumers per kilometer, while GEPCO has 111 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while GEPCO's consumer to employee ratio is 201 to 1. Even though GEPCO is above average in consumers per employee when compared to other DISCOs (see Table 2.9 below), it could improve its financial position significantly by steadily working to improve the consumer to employee ratio close to the US electric cooperative average. Were GEPCO able to achieve a consumer to employee ratio close to the US average, the savings would approach RS 1.7 billion per year.

Table 2.9: GEPCO/US cooperative performance ratio comparison

Category/Performance Indicator	GEPCO	US Cooperative Ave.
Liquidity		
Current Ratio	.79	1.6
Amt. over 60 days/Oper. Rev. (%)	0.90	0.23
Profitability		
Return on Assets (%)	11.2%	5.07%
Op. Rev./km line (Rs.)	3,270,781	1,528,519
Consumers/km line	111	8
Consumers/Employee	201	467
Main Exp/Op. Rev. (%)	.98%	7.98%
Op. Exp./Op. Rev. (%)	6.47%	7.03%
Cost of Power/Op. Rev. (%)	85.8%	70.55%
Plant Utilization		
PRR (one year plant rev ratio)	3.1	6.3
Total plant/km line	1,128,948	2,622,327
Solvency		

Equity/Assets (%)	(4.7)%	42.4%
Long term Debt/Ttl. Capitalization (%)	200.2%	52.0%
Line Loss (%)	11.1%	5.0%
Elec. Sales Collected/Elec. Sales Billed (%)	79.6%	N/A
Government	52.0%	N/A
Non-government	93.9%	N/A

2.4 COMMERCIAL MANAGEMENT

2.4.1 OVERVIEW

This chapter describes GEPCO commercial management practices, followed by an analysis of the impact of selected changes to commercial practices. The policies, practices and procedures employed by it are not unique to GEPCO; they are in general common to all Pakistani DISCOs, varying in scale and degree of compliance. The circumvention of procedures decreases transparency and creates opportunities for fraudulent activities.

2.4.2 SUMMARY OF KEY FINDINGS

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

- **New service connections—** Although new connection application forms are available in all front offices and at the utility website, many consumers seek the aid of staff in completing the application and throughout the remainder of the process to obtain a connection. Several factors, designed to minimize mistakes in the data entry into the CIS, unfortunately contribute to significant delays in consumer billing – sometimes for several billing cycles. Six thousand five hundred nineteen (6519) new connections had not received a bill as of the end of November. Most of those connections (6011) had been connected for 1-3 months. The billing account number is associated with the premises/location and not the customer.

- **Meter reading—** Numerous problems were found in the area of meter reading. Commercial management and employees indicate there is insufficient time to perform the randomized evaluations of meter reading accuracy supposed to occur. Many meters are not read every month; estimates are not identified on the meter reading list or the bill. Meter readers do not consistently identify and record problems with meters.

- **Bill preparation**— The billing process involves manual data transfers and data entry, which often cause delays. The revenue office staff enters all the readings, bill adjustments, and connection/disconnection data for general consumers, and transfers the information electronically to the computer centers. Other readings and all payments are entered at the computer center. The billing program is outdated and batch driven; therefore one division can delay processing for all the circles served by the computer center. Although the computer center prepares exception reports that warn of possible incorrect readings or inconsistencies, as noted generally no action is taken.

- **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. The billing timeframe is very tight; delays in any part of the process will delay delivery of bills.

- **Bill adjustments—**Adjustments to consumer bills can be made at any center, but the bill must be returned to the consumer's revenue office for data entry and approval. Time lags in processing the adjustment results in the consumer returning 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. Updating the consumer balance at month end causes unexplained changes in balance forward and adjustments not to appear on the bill. Bills may be adjusted as the result of revenue audits; only findings in favor the GEPCO are reported.

- **Payments—**Payment handling has many inefficiencies and requires frequent, manual intervention. Scrolls and payment stubs are physically transferred to the revenue office, where the revenue office reconciles stubs and scrolls. The time required to post the payment to the consumer's record usually takes 5 to 6 days. The bank does not accept payment amounts less than that indicated on the bill. Aggressive collections have reduced the receivable balance from 6,190 million Rs at June 30 to 6,136 million Rs at the end of November

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- **Disconnection/reconnection—** GEPCO's process for disconnecting/reconnecting delinquent customers involves a number of separate departments and is not automated, introducing potential risks and delays. Delay in implementation of these orders allows defaulting consumers to continue receiving electricity and increases their receivable. Because the reference number is associated with the premise and not the consumer, it is not uncommon for a defaulter to obtain a new connection before the old account is disconnected. The amounts due from running defaulters at the end of November 2010 was over Rs. 30.6 million, which more than doubles the amount due (Rs. 14.6 million) at the time of default.

- **Customer service**— For GEPCO, customer service is primarily complaint resolution. At the local levels, there are no dedicated customer service representatives. Personnel are assigned to the windows for a few hours and then resume their regular duties; hence there is little or no continuity in resolving customer issues. Policies and procedures are not applied consistently. An efficient and effective customer care system is needed by GEPCO and its counterpart DISCOs, as well as a gender-centric dimension.

- **Meter maintenance—**Meter inspection, testing, repair and replacement are inconsistent at best. There are no meter testing/data download/calibration labs at Circle or Division level. Established procedures are not followed, documentation is not completed, and handling of meters appears haphazard. Management of meter assets would be much better served by enforcing existing guidelines, and introducing a computerized meter repository system. At the end of October 2010, 8713 meters were declared defective but still in the field; 1,144 were declared defective more than 6 months ago.

- **Theft control—**Theft of electricity and related fraudulent activity that reduces revenue to GEPCO is rampant and varied in its manifestations. Many instances appear to involve company employees. The losses may be concealed by over billing. Reconciliation of customer meter readings to known area meter readings, which would highlight areas for investigation, has not been implemented. Lack of government support has hindered the filing of FIRs, preparation of detection bills, and disconnection of non-paying consumers.

- **Meter integrity and meter reading practices—**When a meter is declared to be defective, the consumer is billed either on the corresponding month's consumption the previous year or the average consumption of the last 11 months, whichever is higher. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer. Also, with many meters located 7-10 feet above ground, it is difficult to detect meter tampering. Training has not been provided to the readers on all the different types of meters currently in use.
- **Information technology**—Presently, GEPCO 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. Lack of computer literacy among staff is one of the major obstacles in IT adoption. 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 to achieve fundamental business goals.

2.4.3 ANALYSIS & DISCUSSION

The revenue cycle in all DISCOs, including GEPCO, is governed by three documents:

1. Commercial Procedures, 6th edition-November 2000, plus Amendments which have not been codified.
2. Consumer Eligibility Criteria 2003.
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. The manual was designed to coordinate commercial activities of the various departments, and create checks and balances through record keeping.

In response to the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 (the Act), the 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 and procedures for dealing with the consumer. This 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 and 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 herein and not develop their own.

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's 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 utility to manage an extremely high volume of transactions on a monthly basis with least possible errors. The following sections of this report describe each step of the revenue cycle for GEPCO; much of this information applies to all DISCOs, since they use very similar commercial practices.

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, not the consumer, is assigned a billing account number. Should the occupant of the premise change, the billing account number does not change; only the name associated with the number is changed. Numbers are assigned in the walk order of the meter route, with gaps of numbers to accommodate growth. As new structures are added, the route must be renumbered, and effected consumers assigned a different billing account number

GEPCO's new connection policy is similar for general and large consumers. The difference is in the documentation required and who has the authority to approve the application. Table 2.10 below charts the authorization levels for new connections.

Table 2.10 Sanctioning Authority

Load	Sanction Authority
Up to 5KW	Asst. Manager Operations (SDO)
5-70KW	Deputy Manager Operations (XEN)
70-500KW	Manager Operations (SE)
> 500KW	CEO

New connection forms are available online and at all GEPCO offices. However, application and supporting documents must be delivered to the appropriate utility office. 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. Information obtained during the audit indicates that many consumers seek the aid of staff in completing the application and in the remainder of the new connection process.

Within two weeks of receiving a consumer application, the subdivision conducts 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 given to the consumer. Each DISCO has different security deposit rates as approved by NEPRA. GEPCO charges Rs 1,100 per KW for urban connections and Rs 600 per KW for rural connections. 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, or may not be provided by stores as specified in the cost estimate. 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 is finally connected, the completed SCO is sent to the revenue office to enter him/her into the billing system.

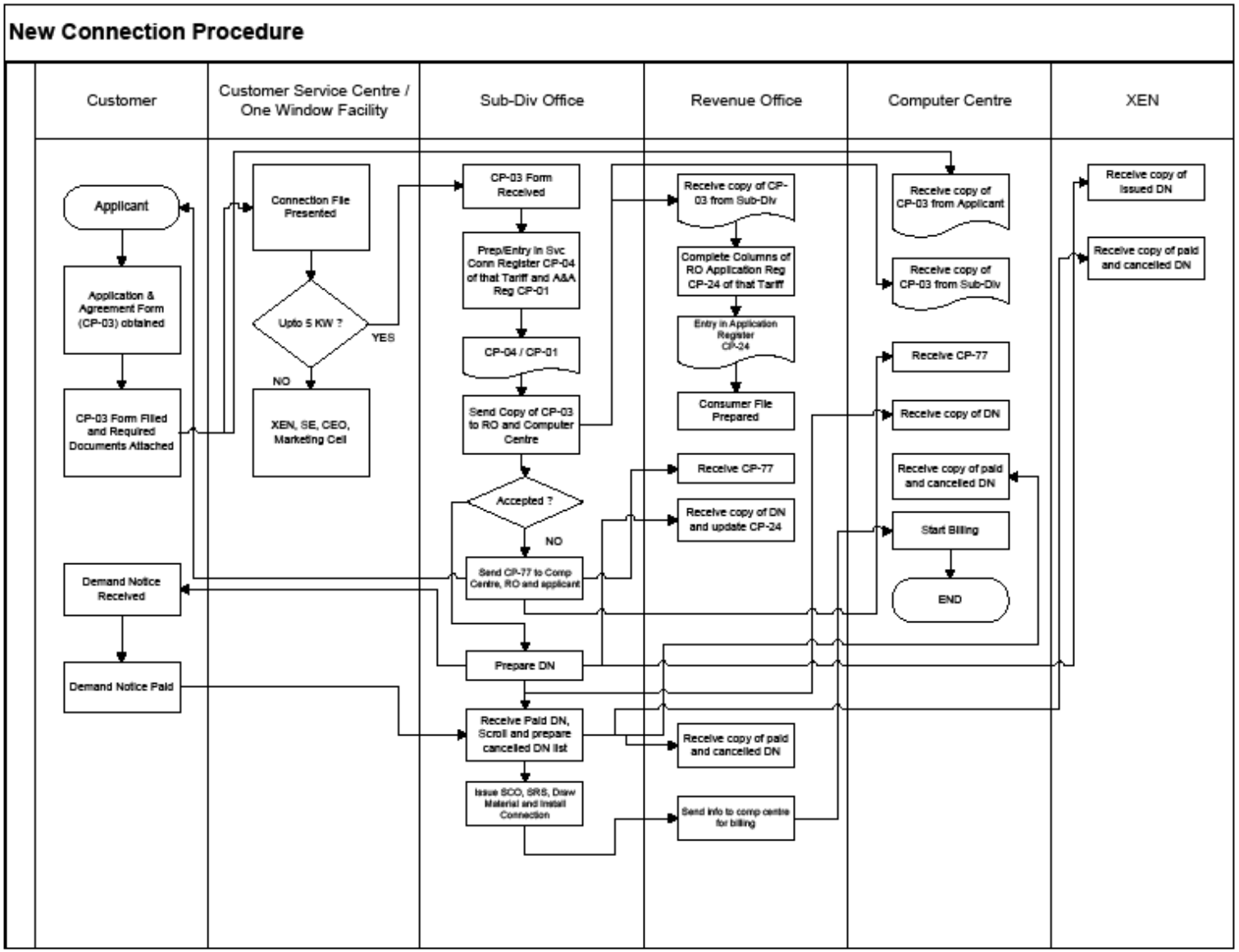
GEPCO follows the prescribed process to some degree. The target is to have new connections installed 35-45 days after the registration of the application. However, the target does not take into account any delay in payment by the consumer or shortage of material in the warehouse. The completed connections register showed that most domestic connections were completed within an average of 46 days of application. During document verification, PDIP's team observed that up to 40 new connections were installed in one day, suggesting a practice of field staff updating the records just before sending a summary to the revenue office; the connections may have been installed earlier

in the month or even in previous months. During the five months ending November 2010, 37170 new connections had been installed. Of the 5041 paid connections at the end of November, 5024 had been outstanding for less than three months.

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. Six thousand five hundred nineteen (6519) new connections had not received a bill as of the end of November. Most of those connections (6011) had been connected for 1-3 months. However, there were 2 that had been connection for more than one year.
The delay in billing the consumer is the result of the process. First, subdivision operations staff prepares a summary of new connections and sends it to the revenue office, usually once a month. This office uses the summary to prepare a "master data addition/change form" to send the customer information to the billing center for data entry with the next meter reading batch.

After data entry, the billing center prints a "posting list" showing new connection details and sends it to the revenue office for verification. If the data is not correct, the corrections are sent back to the computer center by the revenue office through "master data addition/change form" and/or "consumer meter data change form". 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 connections procedures.

Figure 2.1 New Connection


New Connection Procedure
Customer
Customer Service Centre / One Window Facility
Sub-Div Office
Revenue Office
Computer Centre
XEN
Applicant
Application & Agreement Form (CP-03) obtained
CP-03 Form Filled and Required Documents Attached
Demand Notice Received
Demand Notice Paid
Connection File Presented
Upto 5 KW ?
YES
NO
XEN, SE, CEO, Marketing Cell
CP-03 Form Received
Prep/Entry in Svc Conn Register CP-04 of that Tariff and A&A Reg CP-01
CP-04 / CP-01
Send Copy of CP-03 to RO and Computer Centre
Accepted ?
NO
Send CP-77 to Comp Centre, RO and applicant
Prepare DN
Receive Paid DN, Scroll and prepare cancelled DN list
Issue SCO, SRS, Draw Material and Install Connection
Receive copy of CP-03 from Sub-Div
Complete Columns of RO Application Reg CP-24 of that Tariff
Entry in Application Register CP-24
Consumer File Prepared
Receive CP-77
Receive copy of DN and update CP-24
Receive copy of paid and cancelled DN
Send info to comp centre for billing
Receive copy of CP-03 from Applicant
Receive copy of CP-03 from Sub-Div
Receive CP-77
Receive copy of DN
Receive copy of paid and cancelled DN
Start Billing
END
Receive copy of issued DN
Receive copy of paid and cancelled DN

Process

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. Quality issues around meter reading expand the volume of meter reading and billing exceptions, creating the need for more manual intervention and processing.

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 vulnerabilities; no single approach is fool-proof, although some are less problematic than others.

GEPCO and its DISCO counterparts possess checks and balances in the meter reading policies & procedures in an effort to ensure robust and trustworthy metered data. Unfortunately, this is an area of commercial operations for which there is a high degree of distrust and anecdotal information regarding meter reading manipulation by employees. This can occur when monitoring and evaluation procedures are not implemented as per the Commercial Procedures. The targets for line losses are very easily achieved by manipulating meter reads. It is important to note that the purpose of this report is not to present evidence of fraudulent practices, nor to make unsubstantiated claims, but to identify problems that affect DISCO performance, and propose solutions to those noted.

The Commercial Procedures Manual requires routine verification of meter readings and bill deliveries as shown in Table 2.11 below.

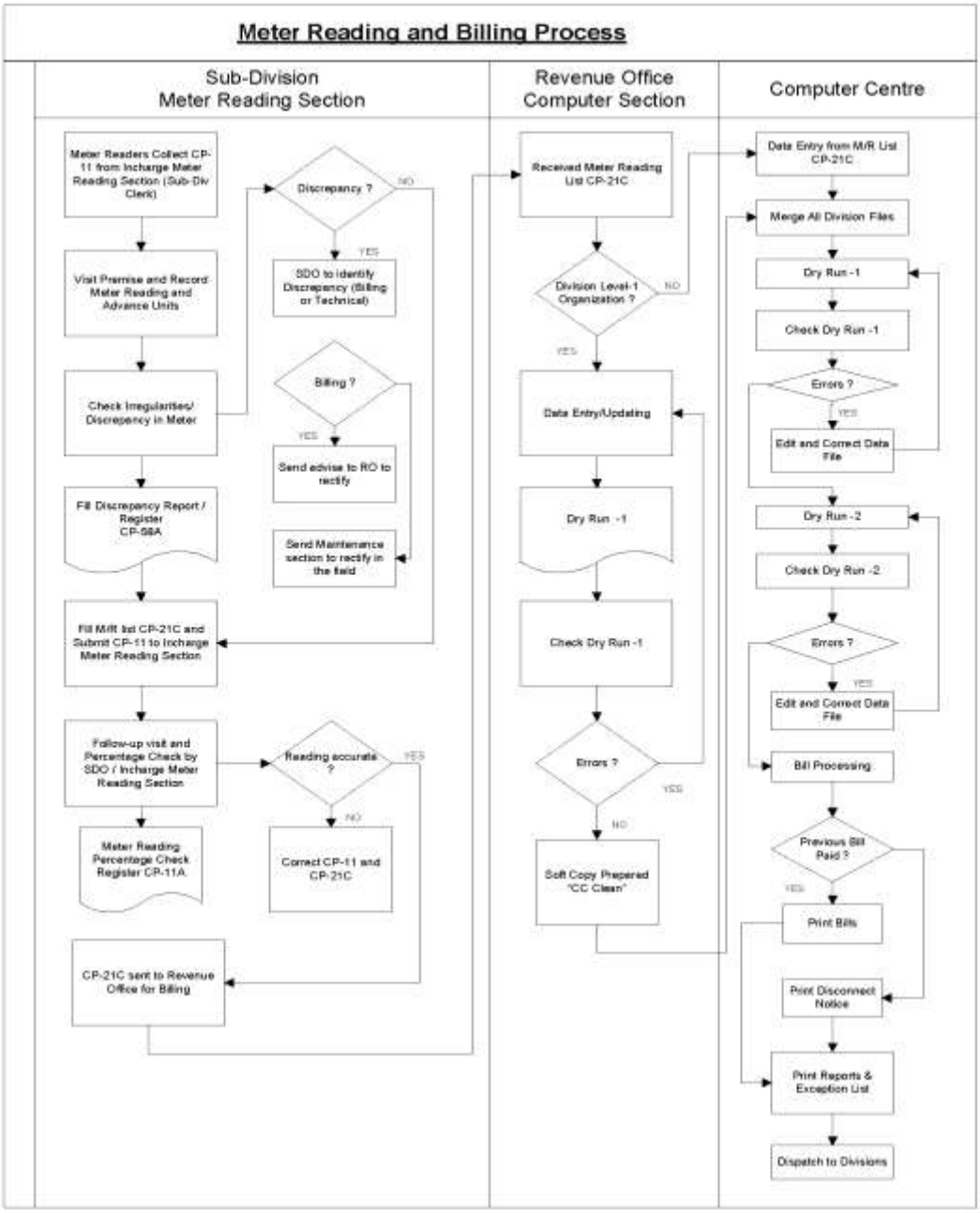
Table 2.11 Meter Readings Verification Responsibilities.

Responsible Officer	Percentage of meter readings to audit						
	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%			
Sub-Division Officer	5 meters per day	2%		2%			
Executive Engineer			10%		10%		2 meters per day
Superintending Engineer						15%	1 SDO, 1 XEN 3 meters

While these measures have been designed into the GEPCO system, interviews with GEPCO commercial staff and record sampling provided little or no evidence that these procedures are actually followed. GEPCO 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. The meter reading verification/auditing functions should be assigned to a work unit with the specific mandate to undertake these duties.

Figure 2.2 below illustrates the meter reading, data processing, and billing processes as described by GEPCO 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. Some meter readers are not technically trained enough to view technical discrepancies. The diagram also shows that the Sub-Division Officer is likewise 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, but these are rarely practiced.

Figure 2.2 Meter reading and billing cycle (general consumers) process diagram



GEPCO divides meter reading into a series of batches to provide for continuous bill processing. The benchmark is for the bill to be given to the customer 10 days after the meter reading. Given that there are 22-23 working days per month, the company divides consumers into 26 batches for purposes of meter reading, bill printing and delivery. Twenty batches are 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 meters 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 the always the case. GEPCO commercial officers stated that exceptions are made where feeders intersect; it is more convenient for the reader to read the meters on adjacent feeders while already in close proximity to them. When possible, the size of the batch is based on the number of readers and the "yardstick" of 2,000 meter reads per month. The batch size is the total number of general consumers divided by 20 working days. The batch is then divided by the number of readers to create the daily route size. However, because GEPCO has been adding a significant number of new consumers (nearly 7500/month) it is possible that many meters may not be read every month. In majority of rural areas consumption is estimated based on historical averages.

The billing center has the aim of printing meter reading lists 10 days prior to the scheduled meter reading date. The lists are delivered to the revenue office and then distributed to the subdivision offices. Because the lists are prepared so in far advance of the actual reading date, new connections go unread for multiple months. The meter reading lists may reach the meter readers 3-5 days after the scheduled reading date. However, the readers do not use the reading list while reading the meters. Readings are recorded in a "Kalamzu book" and transferred to the reading list at the end of the day. Writing identical information multiple times contributes to delay in submission of meter reads to data entry centers, and to transcription errors.

The reading lists contain the consumer number, his tariff code, status code, the previous reading and the consumption for the same month in the previous year. When transferring the current reading from the book to the meter reading list, the reader also calculates the consumption. If the consumption 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 the 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. Sometimes meter reading is intentionally delayed to cover the losses.

Bill Preparation

The meter reading lists from each subdivision are passed to the division revenue office. The transfer process usually requires another day or so. The revenue office enters each batch of readings for all subdivisions under its control before sending the batch to the computer center. A delay at any one sub-division delays the entire batch. Each revenue office has data entry clerks and supervisors who enter all consumer data for transfer to the computer center in addition to the readings. The clerks and supervisors work in shifts in order to get all data entered in a timely manner. One data entry operator can enter on average 5000 reads in a day. Once the data entry has been completed, the total consumption for the batch is compared to the sum of the subdivisions batches, as determined by the reading lists. The data is then transferred to the billing computer center either by email or delivered to the center by flash drive. Data entry/cleaning of readings for MDI consumers (consumers with demand indicators) is done at the computer center

If closing for the previous month has not been completed, bill processing will be delayed. If all batches with the same batch number have not been received from all divisions served by the center, bill processing may also be delayed.

The issue date on the bill is not always the date the bill is actually printed. For the month of December, the scheduled issue date was frequently 3-5 days prior to the date of bill preparation. However the due date on the bill is calculated from the issue date—normally 10-13 days from this. No matter what date the bill is printed, the issue date and thus the due date are the scheduled dates. The schedule allows 2-3 days from the print date for delivery to the revenue office.

The billing program being used by GEPCO 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 was designed exclusively for electricity billing activity; however the COBOL program will not allow GEPCO to include other revenues and security deposits in the bill.

This billing program was first developed by WAPDA and is now maintained by PITC (Power Information Technology Company). WAPDA originally programmed controls to ensure the integrity of the program and the data it contained. It is now controlled by the DISCOs, and many of the controls no longer in use. There has not been a transactional audit since the transfer.

There are 25 billing centers distributed throughout the eight DISCOs. A DISCO may have 1 to 5 centers; GEPCO has 3 (Gujranwala, Sialkot and Gujrat). Customer service centers are connected to the system via the web so that duplicate bills can be produced. No previous bills are stored online and there is no access to billing/payment history. Bill adjustments must go through the revenue offices and this is currently a manual/offline process.

The GEPCO bill format requires modification. The current format makes it difficult for the consumer to determine if adjustments for previous months have been posted to his account, how the arrears (past due balance) amount was determined, or the taxable amount calculated. 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.

Although the computer center prepares exception reports that warn of possible incorrect readings or inconsistencies, as noted generally no action is taken. Many warnings are issued during the data entry process. If the warning cannot be resolved by the computer center, the revenue office is contacted for direction. Frequently, the expedient course of action is taken since there is no time for research or actual verification.

Bill Delivery

The due date should be calculated from the bill print date with an allowance for delivery days. NEPRA policy requires that the consumer have at least seven days from receipt of the bill to complete payment to GEPCO. However the due date is usually the target date prescribed by standard GEPCO revenue practices, without taking into account the frequent delays that can occur while preparing the bills. 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.

The billing timeframe is very tight. Delays in the any part of the billing cycle will result in delays of delivery of bills to the revenue office where the bills are sorted and delivered to each subdivision. The schedule assumes one day for delivery to the customer after receipt in the revenue office.

DISCO personnel are responsible for bill delivery. Bills are hand delivered to urban consumers. Because transportation is not provided, bills for the rural areas are left at a single central location, and consumers are responsible for collecting them. This introduces another source of risk to the bill delivery process.

Bill Adjustments

Bills can be adjusted if required at the customer service centers. If the adjustment is for less than 500 kWh, the CSR has the authority to make adjustments immediately. Adjustments in excess of 500 kWh require verification by field personnel.

When bill delivery is not timely consumers can request an extension up to three days. If a consumer makes a request for partial payment of a bill, the CSR may authorize installments of two to three payments, provided the amount is less than Rs. 10,000. The actual practice differs from the written delegation of installment powers as noted in Table 2.12 The installments apply only to the outstanding arrears. The consumer must pay the current charges and the first installment. The deferred amounts may be charged a mark up at the prevailing bank rate (currently 14%).

Table 2.12 Delegation of Installment Powers

Delegation of Installment Powers

Sr. #	Authorized officer	Category of Connection	Amount in Rs	Installment Authorized
Disconnected Connections				
1	SDO	Domestic & Commercial	5,000	2 to 3
2	Incharge Customer Service Centre	Domestic & Commercial	15,000	2 to 3
3	XEN / Dy. Dir Commercial	All	50,000	2 to 3
4	SE. / Manager Customer Services	All	200,000	2 to 3
Running Connections				
1	SDO	Domestic & Commercial	5,000	2 to 3

2	Incharge Customer Service Centre	Domestic & Commercial	15,000	2 to 3
3	XEN / Dy. Dir. Commercial	All	50,000	2 to 3
4	SE / Manager Customer Services	All	100,000	2 to 3

Due to the fact that meter readings are on occasion estimated rather than read, actual readings in subsequent months can have the result of pushing some consumers into a higher tariff slab. The consumer's bill may be segregated into several periods to lower the total bill, allowing him to avoid the higher slab rates. Bill segregation is at the sole discretion of utility staff, with no follow up procedure in place to establish correctness or responsibility for such correction.

Many customers are poorly educated and have very little understanding of the bills presented to them every month. Some of the consumer services centers have pre-printed forms for the most common adjustments—extensions of due date and installments. The bill adjustment procedure is lengthy and cumbersome, discourages the customer from seeking any amendment in the bill.

Although adjustments to consumer bills can be made at any center, they must be returned to consumers' revenue offices for approval and data entry. The problem that may arise is the time required to deliver the adjustment to the consumer's revenue office, and the time taken until the adjustment is actually entered into the computer. The data entry for the adjustment is sent to the computer center with the next batch that contains the meter readings for the month. If there is a substantial time lag, the consumer may have to return to request another billing adjustment. In other words, the back office procedures do not follow through with actually adjusting the consumer records.

Bills may also be adjusted as the result of audit procedures. Teams, comprised of 2-3 personnel, do commercial audits of all divisions. They audit 100% of the industrial, tubewell, and commercial billings with MDI. The teams also audit approximately 5% of the general consumers' bills. It takes 2-3 months to audit a revenue office. Since there are 23 offices and 16 regular audit teams, each office is being audited about 6 months per year.

The audit is basically a comparison of documents to the billing database. Only findings in favor of GEPCO are reported. It has been observed it cannot be claimed that after the audit teams have audited the record all the exceptions have been documented.

Payments

As mentioned, payments to GEPCO can be made at any authorized bank within GEPCO service territory, local post offices, NADRA kiosks, or electronically. The GEPCO computer centers receive 30% of the payments through NADRA. The rest are from banks and Post Offices.

As payments are received, the pay points prepare a scroll documenting the customer account and the amount paid. If the pay points have online facilities, the customer information may be transferred electronically. Approximately 60% of payment information is received electronically. Scrolls and payment stubs are physically transferred to the revenue office via courier. Posting to the consumer account does not occur until the computer center has received the physical documents.

The revenue office reconciles the number of stubs and scroll entries; this process usually takes 3 to 4 business days. If the bank forwards the scrolls and the payment stubs daily, it takes 4 to 6 days from the date the consumer makes his payment until it is received by the computer center. Posting to the consumer's account is 5 to 6 days after the consumer has paid his bill. 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 bill. If the bill has been adjusted by the utility, the adjustment amount due is 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 GEPCO's collection account daily. The timing of fund transfer is dependent upon the agreement between the utility and the pay points. GEPCO closely tracks the receipts of scrolls and funds. If not received per the agreement, a letter is sent to the bank manager inquiring why the remittances were not received on time.

Although the progressive collection rate thru November is only 80.5% for government customers, the private rate of 101.3% brings the average to 100.2%. Aggressive collections have reduced the receivable balance from 6,190 million Rs at June 30 to 6,136 million Rs. The net arrears for private customers is 2,888 million Rs.

Disconnection/Reconnection

The billing/collection program automatically prepares a list of delinquent consumers who are subject to disconnection through an Equipment Removal Order (ERO) for all those who have not paid their outstanding balances within the grace period (about 5 weeks after the original due date). The list is reviewed by the revenue officer, who has the authority to selectively delete consumers from the list. The EROs for the deleted consumers are cancelled. The actual disconnect list is manually prepared because of the time lag between the computer preparation and adjustments for payments received.

The list, equipment removal orders, and cancelled orders are sent to the revenue officer. The orders are then sent to the technical department to be executed. On a periodic basis, the revenue officer is required to review the status of equipment removal orders to ensure that services have been disconnected. When equipment orders are executed, GEPCO 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, 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 have passed, he may be reconnected, but 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 a new current security deposit and the full equipment costs.

The delay in executing EROs allows consumers to continue consuming electricity, thus increasing the receivable balances due. In some cases, the consumer has obtained a new connection under a different name by the time disconnection is affected. Because the account number is associated with the premise and not the consumer, the consumer continues using electricity while the old account goes into default. The number of connected defaulters is increasing. The amounts due from running defaulters at the end of November 2010 was over Rs. 30.6 million, which more than doubles the amount due (Rs. 14.6 million) at the time of default.

Customer Service

Customer service measures the quality and effectiveness of the company's interaction with customers. The principal points of interaction occur when a customer:

1. applies for a new connection or change of service
2. receives his monthly bill, and provides payment or other communication related to billing
3. contacts the utility to obtain information, review his bill, request that his meter be checked, or make a complaint

GEPCO has four customer service centers, one at each circle. Each subdivision office has a one-window operation that is manned by field staff. The subdivision operations are open 24/7 to handle supply complaints. In addition, there are field complaint offices at various locations throughout the utility's territory to handle service complaints. Generally, billing complaints are redirected to the division or subdivision offices. Many complaints are handled by the SDO and XEN.

Consumers may lodge complaints at any of the Customer Service Centers and at the subdivision offices. The complaints are registered in log books according to the type of complaint. The customer service personnel have the authority to adjust consumer bills up to 500 units (kWh) and to provide up to 3 installments for bills less than 10,000 rupees. The amount due is changed on the customer's bill and the customer is free to pay it.

The adjustment must be returned to the appropriate revenue office for processing and approval. The transfer of information is often batched before sending creating a time lag. Once the revenue office receives the adjustment information, the data must be entered by the revenue office and then transferred to the computer center. The adjustment frequently does not appear on the next bill.

Customer service personnel need to be made aware of the existing GEPCO procedures, which are not consistently applied. One customer service representative will adjust a wrong reading bill for any amount, stating there were no limits or need to verify the reading. Installments can be made if the consumer pays at least half of the bill; others will provide an installment only if the entire current balance is paid. Not all centers have new connection information and they direct the customer to the subdivision offices.

The majority of complaints relate to supply failures. However, the record keeping methodology is such that it is difficult to determine the number and cause of complaints. Various reports provide conflicting numbers. Most bill complaints relate to excessive readings and requests for exemptions from the TV fee.

Commercial department organization

The GEPCO Chief Executive Officer (CEO) responds to the board of directors and is responsible for representing the company in the communities. He manages all headquarter functions, and oversees field operations that are managed by Circle Superintendent Engineers (SEs). Divisions in turn are managed by Executive Engineers (XEN); and Sub-divisions are managed by Sub-Divisional Officers (SDO).

The Customer Services directorate is managed by Customer Services Director (CSD), who reports directly to the CEO; the Manager of MIS works in close collaboration with CSD and functionally reports to the CEO.

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

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

The Revenue Office is headed by the Revenue Officer and 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, reconciliation of debtors' control accounts, and accounting matters as per Divisional Accountant Manual procedures.
- General Section: headed by the Commercial Superintendent responsible for: receiving duplicate copies of certain specified application forms & other connection documents from the sub-divisional offices; and maintaining connection application registers & files for each consumer.
- Billing Control Section responsible for: controlling meter reading & data delivery to computer center; ensuring billing is correct; making adjustments to inaccurate/incorrect bills; issuing disconnection notices; preparing certain management reports & statistics; and bill dispatch.
- Debtor's Control Section responsible for: controlling the computer prepared debtors' ledger; balancing ledgers; carrying out debt recovery action; and maintaining debtors' control reports & statistics.

The following section summarizes a review of the value of changes to GEPCO commercial practices.

Analysis of Changes in Revenue Cycle Practices

During the month of November 2010 Rs. 4,504 million was collected. If the collection period were reduced by 10 days, an additional Rs.12 million could be generated each month, assuming an annual

interest rate of 10%. Potential savings accrued from improved meter readings are yet more substantial, and if there were a better mechanism matching new connections with an increase in customers billed. 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 significant 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. These were designed to provide checks, establish controls and assign accountability for the myriad activities done each month. Many statistics are kept and reported, but there is no indication of corrective actions. Because the same data is transferred from register to register, the statistics do not always agree. Many of the registers were not produced, or were 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 the meter reading cycle. It is difficult to assert effective transaction 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 neither adequately observed nor performed in a timely manner. GEPCO 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 consumption of selected meter readings upwards. Kalamzu books and meter reading lists were found not to be in agreement. Previous reads on the list were greater than the current reads in the Kalamzu books, indicating that the practice has been going on for some time. The addition of consumption to various consumers can be used to manipulate revenue, and allow managers to meet performance targets. Some of this manipulation may be uncovered during data entry, and exception reports may be printed by the computer center, but the reports were filed and no action taken. With the addition of automated meter reading the data is uploaded to the billing program, eliminating the need to manually enter data.

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 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. As material is issued from stores against Service Connection Orders (SCO), there should be a mechanism to update the computer center and revenue office on the impending connection so that billing can be started immediately. This would put a check on field offices as well. SCOs should be in duplicate, and copies sent to the revenue office, who should be responsible for follow-up if the order is not cleared within a reasonable timeframe. The consumer's billing data can be pre-listed when the application is approved, and the consumer ready for billing 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. GEPCO will have better control of its system, and dangerous situations may be eliminated; satisfied consumers being more likely to pay their bills, and promptly, regardless of the "outlandish" tariff rates.

Meter Maintenance

Meter surveillance is done by the M&T (Metering and Testing) teams, but the primary responsibility rests with the meter reader. Industrial meters are checked by an M&T team every six months. The testing procedure is performed in the presence of the industrial consumer. Other meters will be tested if a consumer requests a test, or the utility employee reports an abnormality in consumption, or there appears to be physical damage. If the meter slows gradually with age, it will very likely go undetected. There is no program to routinely inspect/test all meters.

Taking into consideration field observations of meter reader management, location of meters, and the state of many of the meters and connections, 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, many meters are located on poles or high on the outside walls of the premises above eye level. It is doubtful that those meters are actually read, and any damage or abnormality would thus go unnoticed.

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 that were reviewed revealed that the entries are not numerous, and most meters were declared to be working by the line superintendent after checking by the M&T team. It may take several months to replace defective meters. At the end of October 2010, 8713 meters were declared defective but still in the field; 1,144 were declared defective more than 6 months ago.

If GEPCO had its own meter lab it would be possible to fix, recalibrate and return the meter to the warehouse for reuse. If it is not economical to repair the meter, it should be dismantled for spare parts that may be used in future repairs. Periodic meter inspection/maintenance could be outsourced to a third party, or made part of the purchase agreement under an extended warranty/maintenance contract with the supplier, to check and fix meter issues in the field.

Meter serial numbers are not routinely recorded when new meters are received from the manufacturer. Meters are "managed" at the subdivision level. When installed, their serial number is recorded in the Kalamzu book, and in the consumer's computer file. There are no records of uninstalled meters.

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, and 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).

Prepayment 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. This meter is then credited with the value of the purchased credit. After the 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 overbilling, 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.

Meter Reading and Bill Delivery Practices

Although the meter reading "yardstick" is 200 meter reads per day, many meters may go unread. The average subdivision contains over 21,980 consumers. The largest subdivision had 37,477 consumers. On average, a meter reader must read 140 meters each day in urban areas; 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.

GEPCO declares that meters readers are being rotated every 3 months. Some subdivisions rotate readers every 6 months. Rotations may be in form only. A review of a few Kalamzu cards showed the same reader's initials each month for most of the year. 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 localized by trade union representatives, this has led to a lack of transparency, accountability, and absence of checks & balances needed for program integrity.

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 to 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.

Theft Control

With a 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 so that 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 months. Collusion could also result in reporting lower consumption levels, to enable the consumer to be billed at 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 procedures are not followed. XENs and SDOs claim they are too busy to make time for meter reading audit procedures.

Senior management personnel believe a major cause of theft is the high tariff rates. Some subdivisions may practice active surveillance to check for theft. However lack of government support creates a hindrance in launching FIRs, issuing detection bills, or effecting disconnection.

Meter readings submitted for billing purposes are reportedly influenced by the management of the divisions and subdivisions in order to loss targets. Some consumers are overcharged because the excess readings compensate for the under billed consumers. Readings are frequently 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.

Meter Integrity and Meter Reading

When a meter is declared defective, the consumer is billed on the average consumption of the last 11 months or of the same month of the previous year, whichever is higher. 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. It is also possible that many defective meters go undeclared because of collusion.

With meters located 7-10 feet above the ground, it makes it difficult to detect meter tampering. The quality of service installations is problematic; many of the meters are poorly installed. Employees sometimes have to use the tools and small parts (screws, etc.) furnished by the customer. The meters may be loose, crooked etc., making it difficult to state that someone has tampered with the meter.

GEPCO is using meters from different manufacturers. Metering is slowly being changed from the electro-mechanical models to electronic. NEPRA has required that all loads greater than 5KW be metered with Time-Of-Use (TOU) meters. Loads greater the 20KW require an MDI meter. Training has not been provided to the readers on all the different types of meters.

Customer Information System

Presently, GEPCO's distribution system practices are characterized by manual and cumbersome processes, inadequate controls, insufficient commercial focus, limited transparency, little accountability 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 limiting the ability to effectively interface & integrate either with other applications or with potential applications to be deployed in the future. Although the level of IT deployment 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 payment of capital cost and security amount as the material is not available in stores. Availability of service materials is not confirmed prior to issuing the Demand Notices. An integrated materials management and work order module would allow GEPCO to order materials when needed, and connect consumers on a timelier basis.
- GEPCO does not have digital records of paid demand notices.
- Applications for new connections are managed manually (a number of hands and desks are involved), lacking any level of automation.
- Late submission of consumer consumption data to the computer center for billing new connection 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 easily exploited. Furthermore, there is insufficient monitoring of the procedures.
- The customer services activities are not automated. Customer account records cannot be updated real time and the CSR is not given authority, i.e. the customer bill is revised manually but in many cases the same amount appears as arrears in next month's bill.
- Bills may be delayed due to the non-distributed data processing system and batch processing increasing the length of the revenue cycle.
- Only one month's bill information is available on computer master file; historical data is stored offline i.e. in tape cartridges.

- Delayed cash processing/posting (more than 10 days in some cases) delays the cash reconciliation process, and transmittal of collection data to management for decision making.
- Delay by banks in remitting money to company account due to cash collection policy.
- No historical computerized record of service complaints.
- Field staff has no access to consumer historical data to aid in the resolution of complaints.
- No computerized system for distribution loss calculation.
- Maintenance of multiple registers containing identical information is time consuming and counter-productive. Transcription errors lead to conflicting data.
- Unwillingness of non-IT users to adopt new technology is a key obstacle in improvement of customer/utility relationship.
- Certain processes are abused such as processing bill adjustments at the last minute to improve monthly statistics for the DISCO.

2.5 HUMAN RESOURCES

2.5.1 OVERVIEW

Management and staff interviews held at GEPCO led to the conclusion that while the utility 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 and clear responsibilities, with adequate authority on one side and accepted accountability on the other. To all intents and purposes, GEPCO today employs a prototype of the WAPDA legacy HR policies and procedures, not reflecting 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 BOD, PEPCO, or MWP. Owing partly to this situation, governmental (national) as well as internal political pressures are commonly and effectively exerted on GEPCO senior management – which is itself selected by PEPCO rather than by the Board of Directors.

2.5.2 SUMMARY OF KEY FINDINGS

The following are key findings of the PDIP review of HR management.

- The challenges facing the company's HR environment are serious and entrenched, as the DISCOs have historically been subject to outside manipulation – by political sponsors, government agencies, trade unions, and employees themselves.

- GEPCO has yet to develop a strong, progressive corporate culture with clear responsibilities for an authoritative management and an accountable 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. This has facilitated political and administrative pressures on its PEPCO-appointed membership.
- There is lack of transparency in recruitment and promotion processes. Without the necessary checks and balances in the system, an atmosphere of objectivity and impartiality regarding the annual performance review process is absent..
- The benefits and compensation system makes no distinction between "performers" and "non-performers", nor does it reward high risk jobs, such as those of linemen.
- DISCO salaries including GEPCO's are artificially low from adherence to archaic government BPS salary scales, but while this may result in savings to utility operating cost, these are in fact artificial since perennially underpaid employees will not function at peak performance levels. In other countries, low remuneration levels have been linked not only to poor performance, but to corrupt work practices.
- GEPCO has yet to develop updated job descriptions for senior management and key staff positions. Existing post descriptions for senior management remain those of the Area Electricity Boards, lacking clear, specification of roles & responsibilities, educational background & professional experience, and core competencies.
- The health coverage for staff and their dependents is poorly structured, imposing considerable hardships on employees.
- GEPCO senior management has a vision for the company's progressive development, but this has not been effectively communicated to mid-level management and staff, and is therefore not well understood by employees.
- Recruitment of talented staff personnel is inhibited by the low pay scales, and political/government interference in hiring decisions.
- While GEPCO 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 safe and effective fashion. Even though the utility has made efforts to maintain its existing training facilities, these continue to lack proper infrastructure, housing facilities for trainers and trainees, curriculum, and training tools. The facilities are ill-equipped, with instructors not retrained in many years, and training manuals not updated in two decades.
- GEPCO does not employ a corporate performance management system. Instead it uses the standard GOP annual performance review program that is not based upon goal setting or objective performance evaluation.
- The utility lacks a comprehensive training & development action plan and training & capacity building programs. Training offered is largely limited to facilitating employees' advancement within the DISCO system, as opposed to skills development.

2.5.3 ANALYSIS & DISCUSSION

Obsolete WAPDA-era recruitment and promotion processes prevail in GEPCO, as they do in all DISCOs. Career advancement is based upon seniority rather than performance and hiring often influenced by external agencies e.g., MWP & PEPCO. Clear and transparent HR-related rules/regulations have not yet been established. Corporate culture has not developed to reflect a dynamic electric distribution utility.

As in other DISCOs, GEPCO 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 the internal infrastructure, policies and procedures. The organizational structure is inherited from the WAPDA years, with little regard to aligning GEPCO to the changed business, engineering and financial environment.

GEPCO 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.

Modern HR Practices

Throughout GEPCO, staff at all levels stressed the need for fair and transparent HR practices. The need for an HR management system based upon accurate and up to date job descriptions, key performance indicators, and fair and rigorous appraisals is apparent. It is necessary to establish the foundation of a progressive business entity. The utility currently has an HR information system, with a database containing personnel service history, transfers and postings, training details, profiles, death reports, etc, with good querying and reporting capabilities. It is a fairly good system for basic HR functions; however there is a need to develop more advanced analytical modules, and reports that will be beneficial for manpower and planning analysis.

With a systematic approach GEPCO can move towards a modern performance management system. The ability to segregate performers from non-performers would justify the provision of greater

incentives based on good performance. This will create a motivated and competitive work environment among its human capital, and in return the company will prosper.

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

1. Post descriptions complete with educational requirements, training certifications, and professional experience & demeanor for all positions in the company.
2. A fair and transparent hiring process allowing the HR Department to recruit professionals in an objective manner, without external / internal influence or 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 providing increased flexibility to employees and dependents, allowing them to seek and receive health care beyond the WAPDA-centric health facilities.

Analysis of Manpower

Long-term performance improvement will require significant changes in HR management and capacity. A review of manpower statistics was undertaken to understand how resources are allocated, and how well-prepared company employees are to meet the requirements of their positions.

Table 2.13 below summarizes GEPCO's manpower statistics. Only 15% of GEPCO staff are university graduates; about 23% of the workforce is virtually illiterate; and less than 0.8% are women.

Table 2.13 Manpower statistics

Manpower Distribution	**Strength**
TOTAL	**13,400**
Total Officers	309
Total Officials	13,091
Regular Employees	11,354
Contractual Employees	1,972
Daily wages Employees	72
University Graduates	2,020
Secondary Education	8,216
Primary & Complimentary	2,544

Others	620
Female	104
Male	13,400

Table 2.14 shows that a significant number – approximately 23%, and not properly categorized by occupational streams (those shown as "Others (schools, civil works etc.)" -- are not employed in the core utility business. This trend has been observed at other utilities as well, although the GEPCO numbers are significantly lower than at other DISCOs. The conclusion is that GEPCO has either not assigned employees to positions relevant to utility needs, or has become an employment center paying for services not required. Thus it appears extremely feasible that a large number of services could be effectively outsourced.

Table 2.14 Distribution of employees by department

Employees by Department	**Strength**
Executives/ Directors	**236**
Human Resource Department	21
Finance Department	202
Operations Department	7,481
Commercial & Sales Department	489
Administration Department	763
IT/ MIS Department	187
Health & Safety Department	0
Construction Department	13
Training Department	24
Audit Department	84
Security Department	682
Others (store, school, civil, other)	3,126
Total	13,400

Based on data collected, the Central Circle is relatively overstaffed, while Gujrat and Sialkot Circles are understaffed. This leads us to the conclusion that the majority of staff prefer to reside in the urban areas

owing to better facilities (accommodation, healthcare, education etc.) as opposed to the rural areas. There is a need to address this through localized recruitment for the respective areas.

A detailed study will be necessary to carry out long term manpower planning, with the objectives of attaining an educated employee workforce, officers equipped with business and management skills, and a reasonable proportion of women personnel.

Table 2.15 shows a snapshot of GEPCO employees' time in service; 58% have been with the utility for over 11 years. A significant number have been in the legacy WAPDA organization for many years, hence the challenge of changing the corporate culture is considerable. The demographic distribution shows that a reduction in force strategy cannot rely on attrition through retirement alone as only 2% of the staff shall be retiring within the next 10 years; other strategies will need to be considered when evaluations of job structure and employment strength optimization are contemplated.

Table 2.15 Distribution of employees by years of service and age bracket

Years Of Service	**Strength**	**Age bracket (Years)**	**Strength**
0-5 years	2,789	30 and below	3,114
5-10 years	2,732	30-40	3,502
10-20 years	1,753	40-45	1,355
Over 20 years	6,126	45-50	2,471
		Over 50	2,958
Total	**13,400**	**Total**	**13,400**

Analysis of Compensation

A detailed survey will be required to examine market-competitive levels of compensation for GEPCO employees. The data collected and assessed thus far indicates that salaries and benefits are far below reasonable levels needed to attract and retain valued employees.

DISCO regular employees are compensated through legacy WAPDA BPS pay scales, as noted earlier. Salary-related benefits such as allowances, bonuses and increments are treated under the same system. Under the system, there is no distinction between "performers" and non-performers". The system does

not reward high performers, or jobs with high risk, such as linemen, who prefer to move to other positions or ask for early retirement.

The BPS can be circumvented when an employee is hired on "contract". The pay package for such personnel is considerably higher than the BPS-based remuneration of regular GEPCO staff. The Director Finance was hired on this basis and draws a salary appreciably higher than that of the CEO.

Private sector employees are paid salaries that are yet higher; the CEO of NEPRA earns approximately thrice as much as GEPCO's CEO (see Table 2.16). An even more striking comparison is that a newly qualified engineer hired from the private sector would draw a salary equivalent to that of the utility's CEO.

To arrive at a more definitive answer to the question of desired compensation/benefits package in a private sector entity, there will be a need for a market-based compensation survey, with a much broader scope, and most probably carried out by a professional consultant/HR firm. However such a package will only be possible when the company is freed from government's control.

Table 2.16 Compensation comparison of GEPCO and other companies

DISCO		**NEPRA**		**NESPAK**		**PTCL**	
	Rs'000		Rs'000		Rs'000		Rs'000
CEO	114	Chairman/ Member	382	CEO	N/A	President	Spl. Pkg.
Director / Chief Engineer	98	Director General	338	Exec. VP	278	Exec. VP	425
Mgr. / Superintending Engr.	94	Director	265	Gen. Mgr	217	Gen. Mgr.	287
Deputy Mgr. / Exec. Engr.	79	Dy. Director	203	Princip al Engr.	114	Sr. Mgr.	170
Asst. Mgr. / Sub-Div. Mgr.	58	Asst. Director	140	Jr. Engr.	84	Asst. Mgr.	90

Organization

The organizational structure employed by GEPCO and other DISCOs is designed to employ distribution circles as large geographic management units that are managed as full service utilities – less 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 GEPCO 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, so to speak, 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 operations measure the success of the operation department and, therefore, must be independent and are best managed by managers and staff that have the educational and experiential background, as well as the institutional objectives aimed at optimizing distinct objective functions. Commercial activities have the objective of effectively managing the process of connecting and/or disconnecting services; metering energy consumption; recording consumption data; billing consumers for energy consumed and other services provided; and, collecting receivables from consumers. Distribution system operations focus on operating and maintaining the distribution system infrastructure, including recording bulk energy transfers into and out of substations; performing substation and line maintenance; and, management of minor system expansion activities.

GEPCO'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. The CEO, whose principal responsibility is to ensure that the DISCO is moving towards progressively effective and sustainable operation, should not be saddled with administrative responsibilities that create a distraction from the chief goals of the DISCO—financial sustainability. Under the present structure, the CEO has far too many direct reports, including all senior operating staff. That is, engineering planning, DISCO operations, DISCO commercial functionality, DISCO administration, and DISCO financial management should be managed on a day-to-day basis by highly competent managers without CEO involvement, other than to set objectives and to review progress towards these higher level achievements.

Human Resources Organization and Management

In addition to functionality challenges, the HR Department is faced with organizational issues. The Manager, Labor & Litigation currently reports to the Director HR/Administration; it is proposed that this unit be upgraded to Legal & Corporate Affairs. GEPCO managers provided feedback on the suitability of the HSE unit should report to the HR Department to be more effective. Currently the Deputy Director Safety is reporting to Director Operations.

All HR functions are currently managed in GEPCO headquarters. There are no HR representatives at the Circle levels. The utility relies upon administrative staff to manage HR issues at Circle level, but these employees have no training or expertise in conduct human resource training activities or in advising employees on their rights and obligations re. the company.

Health and Safety

The accident records of the past three years (table 2.17) show that GEPCO has a very poor record of safety in its operations; there have been 4 fatal accidents in the first six months of the current fiscal year, 6 in the fiscal year 2009-2010, and a total of 23 in the previous 3.5 years. This is attributed to a lack of implementation of safety procedures, shortage of safety gear & equipment, and non-adherence to safety standard operating procedures (SOPs) by the line maintenance staff. The number of non fatal accidents is also correspondingly high. There is no accurate figure available on accidents met by the public with GEPCO, and therefore could not be analyzed.

Table 2.17 GEPCO Accident rate of last 3 years

Year	Event	Fatal	Non Fatal
7/2010-12/2010 (Last six Months)	7	4	3
2009-2010	20	6	14
2008-2009	14	4	10
2007-2008	19	9	10

The prevailing safety training is not affective as evidenced by the high number of injuries and accidents in recent years at GEPCO, as noted above. The company has not developed a well structured safety

program with clearly defined policies & procedures governing linemen's working conditions: to provide continuous realistic training; institute an incident reporting system to record/evaluate all workplace injuries; and enforce the protocols & practices in line construction, maintenance, and system operations.

Safety is also similarly not prioritized with respect to GEPCO's consumers. Awareness education for its public on the proper use of electric power – and the risks involved in inappropriate or illegal contact with power systems – has not been adequately addressed.

A well structured safety program will require a significant investment in training, protective gear, tools, and monitoring. It will require a cultural shift in the workplace, aimed to dramatically reduce accidents and deaths

GEPCO employees as mentioned earlier would significantly benefit from a diversification of health care options, moving away from WAPDA as the primary service provider. to increased options to provide primary health care for employees and their family members. The current coverage for employees and dependents is poorly structured and involves considerable difficulties for employees.

There is a lack of choice for employees and dependents to obtain medical care (out-patient and in-hospital). They are restricted to using the WAPDA central hospital in Gujranwala or a peripheral health care center, requiring considerable travel and not necessarily possessing the required services. Alternatives such as health care through insurance, or paying a fixed proportion of salary for outdoor treatment, have not been evaluated or brought up for serious consideration.

Recruitment

Effective recruitment begins with well-defined position descriptions specifying core competencies, experience, level of responsibility and authority, and compensation levels. Once these attributes are defined, the human resource department can advertise for candidates to fill vacancies both within and outside of the Company.

As mentioned above, the position descriptions even for the most important jobs in GEPCO are not defined, do not specify core competencies, required educational background or level of responsibility. The position descriptions are too general to be used effectively to guide the recruitment process.

The compensation package is certainly well-known within Pakistan, but it is not competitive with similar private sector jobs. It is certainly not an inducement to attract well-qualified candidates to assume key roles within GEPCO.

Lastly, the recruitment process itself is often short-circuited by direct appointments made by PEPCO and/or the MWP. This practice violates the concept of an independent electric distribution utility, and forces GEPCO and other DISCOs to absorb non professionals into positions for which they are unsuitable. A more objective, independent, and transparent process is required to support operational improvement and DISCO independence in the future.

The policy of reserving 30% of published vacancies for employees' dependents has a direct, negative impact on the type and quality of candidates selected. From 2008- 2010, 570 or 29% of the 1,935 new employees were hired on the employees quota. It is imperative that fair and transparent policies and procedures are adopted to put a curb on both these menaces.

Performance Management System

GEPCO does not employ a corporate performance management system. In 2009 like other DISCOs it changed the annual evaluation system from the public sector ACRs (Annual Confidential Reports) to the PEPCO-pattern Performance Evaluation Reports (PERs), essentially the same review in a different format. It does not feature goal setting or objective performance evaluation, and is seldom shared with the employee unless adverse.

A robust performance program needs to start with well-defined position descriptions that establish the performance expectations of employees, the core competencies, reporting requirements, and professional demeanor that is expected of each employee. The ideal performance review process should include goal setting, discussion between employee and supervisor at the outset of the year, and an objective review & evaluation midyear and at year end. Since, advancement is based almost entirely on seniority rather than on achievement, there is at present scant incentive for employees to improve skills and generally invest themselves in their jobs.

HR Policies and Procedures

GEPCO has not developed a consolidated and easily accessible set of HR policies & procedure manuals for staff and management. From recruitment to retirement, clear cut rules and regulations are required.

In place of policies and procedures that serve GEPCO needs as a large and growing corporate entity, GEPCO has continued to employ legacy WAPDA HR policies that reward longevity and seniority, rather than high performance and dedication to GEPCO's mission.

Many of GEPCOs HR policies and procedures date back to the early 1980s, and in some cases have little relevance to high functioning electric distribution utilities. The longest serving HR Department staff is usually the most familiar with all rules & regulations and how and where to find them, rendering non-HR staff dependent upon the Department even for minor matters e.g. leave sanctions. In such scenarios, objective, equitable operations are bound to be compromised. Where policies or procedures exist, there is an inadequate implementation, leaving the door open to influences, both internal and external.

Employee Handbook

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

Training and Capacity Building

Like the regional training centers (RTCs) at many DISCOs, the GEPCO RTC requires substantial rehabilitation; not only of the building but of the training material and trainers. Based on discussions with training staff and visits to these facilities, it is clear that training tools, manuals, and other aids are inadequate to meet the growing training needs of GEPCO employees. For instance, linemen are trained with tools not commonly available or provided to the line workers; whereas the line workers are rarely provided basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective manner.

GEPCO does not have a comprehensive training and development action plan for all employee levels. The concept of capacity building is also absent. The training that is offered is mostly targeted to allow employees to advance within the organization that is preparing employees for promotions rather than skill development. GEPCO has not designed or implemented an effective needs assessment plan for future training programs. The training facilities are ill equipped; instructors have not been retrained in many years; training manuals that were developed in the 1980s (under a USAID program) and have since not been updated. The training program also lacks a program to perform post training impact evaluation to measure the effectiveness of the offered programs.

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

Commercial training:

1. *Meter reader training.* This should focus on familiarizing meter readers with new metering technologies: to use handheld electronic meter reading devices; to identify and record meter faults, meter tampering, & meter maintenance requirements; and to carefully record and transcribe 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 & advanced safety training to linemen and line superintendents.

2. *Work planning management.* Train line crews to work more effectively to complete tasks on 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 GEPCO staff could and should develop improved manual mapping and planning tools.

4. *Line design.* GEPCO and other DISCOs do not actually design distribution line; they use rules of thumb as a proxies for engineering design practices & procedures. This results in high cost, and often 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.* GEPCO internal auditors focus on only one of several internal audit obligations as outlined in the IA Manual – identifying low/inaccurate meter reading. Internal audit obligations are far broader than only focusing on meter reading.

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

Human Resource Management

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

2. *Human resource planning and forecasting 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 employees and staff with the performance evaluation program.

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

2.6 COMMUNICATIONS AND OUTREACH ASSESSMENT

2.6.1 OVERVIEW

GEPCO is an electricity distribution company with 2.4 million customers and 12,590 employees (sanctioned employees strength is 14,590). The blend of its consumers includes industries of Gujranwala, Sialkot and Gujrat in addition to agriculture, households and commercial. It had average monthly revenue of Rs. 3,961 million during 2009-10. The role of effective internal and external communications and outreach assumes paramount importance with such a diversified consumer base and high turnover.

GEPCO inherits its internal communications policies and practices from its predecessor organization - WAPDA. Although considered an independent organization, it is subordinate to policy/administrative control of PEPCO, WAPDA and MWP. This relationship determines its culture of internal and external communication characterized by over-reliance on manual, traditional and time-consuming inter-office correspondence.

The company faces the major challenge of building its corporate image against the frequent tide of criticism received from customers due to chronic power shutdowns, tariff increases and an aging distribution system. Currently, the Public Relations (PR) department enjoys limited empowerment and can engage in external communication at the local level only. Mass media campaigns are managed by PEPCO, where GEPCO merely contributes its share as a partner DISCO. It has no role in the development of media campaigns, content development, choice of advertising agency, media mix, or planning.

The following sections present the context of internal and external communications and outreach activities at GEPCO and offer recommendations for priority areas:

2.6.2 SUMMARY OF KEY FINDINGS

The following are key findings of GEPCO's communications and outreach:

- **Internal Protocols and Practices of Communication:** Internal communication is based on a manual "file-driven" culture of developing correspondence notes, subject to approvals of multiple signatories, mostly delivered through a typical diary system. The obvious casualties in this regard are speed, transparency and flexibility.

- **Corporate Communications and Consumer Outreach:** Due to GEPCO's minimal presence in the mass media as an independent entity, a strong and independent corporate image has not developed, resulting in low brand equity amongst its consumers.

- **Public Relations Department:** The PR department is the focal department for local media. Its limited function, meager budget and exclusion from mass media campaigns are factors that define the ambiguity of its role within GEPCO.

- **Limited Role of the MIS Department:** The role of the MIS department is largely restricted to processing of bills, printing, and data-processing activities. Its potential role as a catalyst of organizational cultural change has not been effectively explored.

- **Low IT Penetration:** Computer literacy within the ranks of management is very low, evident from the limited scale of adaptation to new technologies. As a result the usage of computers as a preferred mode of communication, information management and data-processing is not widely practiced.

- **Media Mix and Products:** The role of outreach as a tool to build a desired corporate image and educate consumers has not been explored. Only a few need-based products and occasional outreach activities have been carried out to date, without maintaining a regular calendar of activities.

- **Customer Service Centers:** Customer service centers have been set up at sub-division, division, circle and head office levels. These centers are the least friendly spaces to welcome consumers. With a modest office setup, lack of information material for consumers and no database connectivity, they are not functioning to their full potential.

2.6.3 ANALYSIS AND DISCUSSION

GEPCO is an electricity distribution company serving a diversified consumer base which makes it imperative to have a robust and effective communications and outreach. Unfortunately, like any other DISCO, proactive communications is also seen to be a low priority area at GEPCO. The communications and outreach assessment was conducted to review the state of both internal and external communications of GEPCO. The results are discussed as under.

Internal Communications Process

GEPCO has four circles, 23 divisions and 113 sub-divisions to serve its customer base of 2.4 million. For a large organization like this, there are two primary facets of internal communication that should be evaluated:

a. The modes and tools of inter and intra departmental communication.

b. The speed and effectiveness of communication with field offices and staff.

The existing practices and policies reflect the prevalence of archaic forms of inter and intra departmental communication protocols. As a result, information sharing becomes an uphill task between cross-functional teams and departments.

Internal Communications Policies and Practices

GEPCO is theoretically an independent corporate entity governed by its own Board of Directors. However, in practice, its autonomy is continuously challenged by the dominating and decisive role of PEPCO, WAPDA and MWP, which largely determine its culture of internal and external communications as a continued legacy of a public sector organization.

The hallmark of these practices is inter-office correspondence based on traditional modes of manual communication for routine correspondence between various departments. This ensures that hard copies of inter-office memos are maintained as records in heaps of files. Electronic mode of communications and storage of correspondence is not practiced except in the MIS department. The focus group discussion with the staff transpired that not much effort has been made in the past to promote modern communications culture which has culminated in the continued observance of obsolete systems of communications, which inevitably make internal coordination slow and time-consuming.

Adoption of Information Communications Technology (ICTs)

The senior and middle management either lacks computer literacy or is unwilling to use information technology as a modern means of communication. The visit to the regional training center revealed that a couple of training modules are dedicated to imparting basic IT skills to staff. However, a general lack of interest by staff seriously limits the acquisition of IT skills in the utility.

At present, there are about 470 computer terminals in use at different GEPCO offices. Of these, only 23 are connected with broadband internet. There are more than 60 official e-mail addresses but their use is likewise not current.

Information management and digitization of corporate data, rules and regulations through ICTs is scarcely practiced, except marginally by the MIS Department. The implementation of ERP is at an early stage of planning and may take a long-term effort to materialize.

The MIS Department has demonstrated its ability to develop some 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 apparently has the capability to impart training and provide support at the managerial level, to spearhead the transition to a dynamic communications culture.

An adequate and reliable database of employees, rules & regulations is not available for ready reference and easy access. The current web page is an example of a potentially powerful communications tool for

improved communication. The MIS department updates the relevant information on the website. However, no dedicated webmaster is tasked with comprehensive oversight and management of the website.

Communication for Team Building

There are a few team building activities conducted by GEPCO, and include staff get-togethers on special occasions, usually farewells of retiring employees or staff welfare-related events. No other activities were reported such as Eid celebrations, special events, commemorations, seminars, family gatherings, staff functions, open houses etc.

External Communication

As noted earlier, GEPCO is faced with the daunting task of developing a strong corporate image. Ironically, the company is not responsible for power shutdowns or tariff increases but has to face the consequent criticism from external stakeholders, at times bordering on consumer hostilities. Public outrage against tariff hikes and load-shedding has led to many angry protests in the past; a few of them leading to violent attacks on its field offices.

The local media in Gujranwala is very proactive and aggressive in highlighting the issues of price hike, system failures and corruption among field staff. In order to counter this constant barrage of criticism, the utility needs consistent efforts to improve its external communications and outreach. It should focus on promoting its services, investments, and plans for upgrading the system and improving customer relations. At the same time, it needs to create awareness among consumers against theft and other malpractices to minimize its revenue losses.

Public Relations (PR) Department:

The PR Department at GEPCO is responsible for external communications and outreach activities. It is headed by a Deputy Manager and assisted by two staff members - a computer operator and a photographer. The department is under the administrative control of the HR & Administration Department but functionally reports directly to the CEO and serves as a focal point for the local and mainstream media. It had a limited budget of Rs. 4.2 million during 2009-10. The main functions of the PR department include:

1. To scan the national & local newspapers and prepare a daily summary for the CEO.

2. To prepare and issue press releases on GEPCO's activities, public notices, procurement notices, shut down announcements, etc.
3. To liaise with local press & electronic media for clarifications and media coverage.
4. To maintain liaison with PEPCO for corporate & external communications activities and media queries and with the Press Information Department (PID) for listing of approved newspapers, rates, etc.
5. To liaise with the designated advertising agency – Midas (Pvt.) Limited - for preparation of press & electronic media campaigns, as well as media response.
6. To arrange compilation & publication of a monthly newsletter projecting the company's corporate activities.
7. To manage development & printing of promotional and information material eg. posters, leaflets, etc.
8. To arrange outreach activities including seminars, events & press briefings on corporate and power-related issues.

Outreach Activities

The outreach activities carried out during the last year were few in number and were planned on an ad-hoc basis. These included a few seminars held on energy conservation; and a few posters and leaflets produced on safety and energy conservation. A monthly newsletter is published highlighting GEPCO's activities.

Customer Service Centers

GEPCO has a main customer service center at its head office and customer complaint centers at circle, division and subdivision levels. It is important to note the absence of a dedicated team of customer service staff deployed at any of these levels. Rather, staff belonging to field operations is deputed part time to these centers, and is thus not trained at all in customer handling techniques.

It was observed that the record of customer complaints is maintained manually. The customer service centers are not networked with other departments. A quick review of the existing system reveals that manual data can be digitized for maintaining a convenient database, and undertaking subsequent data-analysis for better customer complaint handling.

Customer complaint centers do not have sufficient information material, such as posters, brochures and flyers to display for the assistance of incoming consumers and to explain the process of complaint handling, the chain of supervising officers and salient points of customer service guidelines.

3. CONCLUSIONS

3.1 GOVERNANCE

The Board of Directors has historically not functioned effectively as a corporate board, its CEO been appointed by PEPCO rather than by the Board. The newly reconstituted BOD will need both governance and electric utility training. Its Directors will require training to prepare them for the challenging of governing GEPCO in the changing utility environment in Pakistan, and to advise Board Members of their roles and responsibilities vis-à-vis MWP, NEPRA, and other stakeholders in the power sector. The Internal Audit Department should report directly to the BOD's Audit Committee.

The BOD should be formally established as the utility's independent governing body, with ultimate decision-making authority, empowered to (1) set the company's policy, objectives, and overall direction (2) adopt bylaws (3) appoint members to its the advisory, executive, finance, and other committees (4) hire, monitor, evaluate, and fire the CEO and senior executives (5) determine and pay the dividend and (6) issue additional shares.

3.2 ENGINEERING

The Engineering section of this report presented the process whereby the PDIP engineering team prepared an evaluation of GEPCO's distribution management system, and the results of a mapping and loss assessment effort. This section will present the team's conclusions, as well as recommendations regarding opportunities for improvement.

Transmission Network

The team did not carry out any specific analyses of the transmission network as GEPCO is upgrading all 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.

Planning Processes

GEPCO'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.

An 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. 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. GEPCO could therefore have a fully up-to-date mapping and analysis system, at low cost.

The company at present has no personnel capable of using a new system, though they are competent professionals with the ability to adapt to a GIS environment, and to make use of advanced analysis tools with proper training.

Standards and Specifications

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

1. 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 Lahore 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.
2. Open conductor LT is an invitation to theft, as well as a source of consumer outages. GEPCO 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.

Procurement Effectiveness

The PDIP team observed that GEPCO's procurement process fails to take advantage of the principal opportunity for reducing the costs of materials, and that is the economies of scale. The utility procures a large amount of goods annually, which should give considerable leverage in obtaining favorable pricing. However the procurement process breaks this relatively large quantity into over 100 separate solicitations, largely diluting the benefits that could be obtained. GEPCO is still using the legacy WAPDA category system which tends to break procurements into a large number of individual solicitations. When WAPDA was a government agency this was necessary to ensure all vendors received some portion of the orders, but now that GEPCO 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 several countries and offer better pricing & higher quality. Again, this may have been appropriate in the WAPDA era when it was considered policy to encourage local suppliers, but any action limiting 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 GEPCO's needs for materials could be satisfied by 8-10 procurements a year; two each for poles, hardware & accessories, cable & 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 appears to lack 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. As noted, the use of solicitations for all procurements has public sector precedent, but a corporation needs more agility than can be provided by perpetuating this practices 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.

Construction Quality

Construction at GEPCO is carried out by employees as well as by the local contractors; local contractors dealing with village electrification projects whereas company construction staff handle ELR , DOP and other deposit works The construction quality in GEPCO is generally good. However, the PDIP team determined that the Construction Department is entirely self-policing, there being 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 not using connectors on jumpers and other joints. It is clear that at one time GEPCO construction 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 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 provide far superior connections with much lower resistance than wrapped joints.

Operations

The Operations Subdivisions at GEPCO are responsible for many activities, but those on 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 repair of faults.

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

The subdivisions were discovered to be 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 scant with no recurrent training, safety meetings, or program for enforcement of safety rules. Protective equipment such as safety belts and grounding sets are of poor design and 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 GEPCO to provide appropriate equipment, and recurrent instruction in its use & care.

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 they are more resistant to tampering than the older electromechanical meters. However, the primary threat to meter security is not the meter itself, but 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. GEPCO has taken no steps towards 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 in 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.

Technical Losses and Loss Segregation

The team carried out a mapping and modeling effort on a sample of the feeders, transformers, and LT networks in the GEPCO 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 GEPCO were found to be 4.9%, broken down as follows:

- Conductor Loss 1.5%
- Transformer Loss 2.2%
- LT Network Loss .9%
- Service Drop Loss 0.3%

This estimate for total technical loss was almost 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.

The level of technical loss can be compared to the total distribution network loss of approximately 10.2%, indicating that commercial losses are in the order of 5.3%. GEPCO needs to make concrete efforts to limit technical loss and that GEPCO's major challenge in loss reduction is in the area of non-technical loss, although important opportunities still exist in reduction of technical loss.

Opportunities in Loss Reduction

The opportunities for loss reduction in GEPCO are more on the non-technical side but at same time technical loss reduction also needs attention.

Mapping and Planning Improvements Identified:

- *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. Use of GIS will allow the automated transfer of system information to advanced planning software, speeding the production of integrated plans, and allowing planning staff to identify areas in which interventions are required for loss reduction.
- *Application of advanced 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 consideration of potential problems before they result in high losses or poor service quality.

HT Improvements

GEPCO's average feeder length is almost 46.9km, which means that the system is somewhat rural. 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 to 95% would reduce losses by 27% on the longer sample feeders.
- *Selective re-conductoring.* 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 45% of GEPCO's technical loss, and technologies exist to cut even the current new specification losses substantially.
- *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 300 amp 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.
- *Re-design of dropout cutout for transformers and use of gang operated switches in place of dropout cutouts on 11kV trunk lines and for sectionalizing.*

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, do affect consumer service quality.

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 would have 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 accommodate 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 used in industrial metering boxes with either direct reading meters or higher quality CTs.* There have been a number of instances of CT failure, which compromise 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.

3.3 FINANCIAL MANAGEMENT

While GEPCO collections are reportedly at 94% of commercialized energy sales, there remains an on-going problem with government collections, reported as only 52% of energy sales in FY 2010. Given the utility's role as a quasi government agency, it is unwilling to take further measures to collect from these clients.

As reported in the results chapter of this report, GEPCO has a reasonably effective arrangement with the banking system and other local payment to collect funds from its consumers. This arrangement ensures that collections are managed effectively and relatively efficiently. However, there are two issues with this collection system. First, many collection points – including some banks – retain customer payments to GEPCO for much longer than they should – often up to a week. Though approximately 75% of cash receipts are received on the same day they are paid to pay points at GEPCO's principal bank account, about15% of cash receipts are received through NADRA involving 1 days' delay in reaching GEPCO's account. The remaining 10% are receipts from post offices taking 2-3 days. Remittance of these funds from GEPCO to the CPPA in payment of purchased power is important, and creates a significant loss from the CPPA's perspective.

GEPCO needs to proceed with the ERP framework which will improve the operational efficiencies and reporting capabilities of the organization. It 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 utility operations; and to convert from manual to computerized systems. The ERP software system interface will allow other applications e.g. CIS & GIS to be integrated with Oracle based system applications, and permit full system interface.

Enterprise systems allow electric utilities to employ financial & management controls that might otherwise be absent. Full implementation of an ERP at GEPCO, for example, will allow an internal control audit to identify and address vulnerabilities in accounting and workflow management.

GEPCO needs to expand and enhance internal audit practice/procedures established in 1985 and not updated since. The archaic WAPDA Audit Manual is too narrow in scope to effectively audit company financial/functional activities, and will not be sufficient to perform auditing procedures in an ERP environment. It requires urgent revision and updating.

The internal audit division has only partially complied with the scope defined in the existing audit manual, that states, "Internal Audit Division has 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 are rectified as far as possible.." At present, the internal audit only functions as a limited review of certain transaction based activities. The internal audit approach focuses only on transactions rather than full reviews of internal control systems. Also, IA reports directly to the CEO with no direct reporting to BOD.

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

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

- PEPCO has currently placed a ban on the purchase of new vehicles, although one third of GEPCO's fleet is 20 years old or older.
- In 2008 four DISCOs including GEPCO were asked to obtain loans to pay for government shortfall in power costs incurred by all DISCOs.
- All DISCO investment projects are required to be filed with the Planning Commission (PC), CDWP and ECNEC for approval regardless of funding status, a time consuming, labour-intensive process.

Finance and Accounting Recommendations. GEPCO should:

1. Hire a Consultant to revise and update its Accounting and Internal Audit Manuals in line with DISCO modernization; to increase internal auditing scope to more effectively assist the Board of Directors, and adjust to the new ERP environment.
2. Evaluate ways and means of improving transfers from pay points to GEPCO bank accounts.
3. Complete implementation of the ERP platform, and expand its applications to serve all finance and accounting needs in line with control, management, and financial reporting to the GEPCO BOD, NEPRA, and MWP as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization.
4. Obtain insurance coverage for buildings, equipment, inventories, and such other assets as deemed necessary to eliminate exposure to significant financial loss.

5. The IA Department should have a dual reporting role (1) to the CEO for assistance in establishing direction, support, and administrative interface (2) to the BOD Audit Committee -- for strategic direction, reinforcement, and accountability.

An observation of the PDIP team is that GEPCO suffers from a lack of reliable access to long term capital. Because of its wholly owned government status, banks are reluctant to lend significant amounts unless ordered to do so by the government. A classic example is the order by the MWP in 2008 for GEPCO and a number of other solvent DISCOS to obtain loans to support the government's own shortfalls in financing power costs for other, less solvent DISCOS. In the face of such risks, it is no surprise that GEPCO'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 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 a 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.

3.4 COMMERCIAL MANAGEMENT

Commercial policies & procedures at GEPCO are defined in logical fashion, but not effectively practiced. Moreover, these have not kept pace with changes in technology, perpetuating manual methods of recording, transcription, and data transfer. These needs to be changed at the earliest possible to electronic data collection and processing, also reducing the potential for manual adjustments and interventions resulting in loss of commercial integrity.

The meter reading practices currently employed are subject to influence by operations management. Given that the goals of network operations and management are distinct from the goals of the commercial department, there is a need to realign 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 commercial management of GEPCO. 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 on industrial clients and transformers would make energy accounting more readily available, and would support work planning & analysis of the distribution infrastructure.

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 delivered to the consumers." The XEN is also charged to physically check site readings and distribution of bills. The SE is not only required to check readings, but also required to review the meter reading auditing checks by the SDO and XEN. GEPCO management and staff readily stated that these practices are not followed as required by company 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 increasing 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 required to sanction changes. Without transaction audits, utility staff may make changes to the database without fear of detection. Audits are common in most well-managed electric distribution utilities.

Billing cycle and energy accounting

Streamlining the billing cycle will result in financial benefits to GEPCO and/or to CPPA. Improving billing cycle efficiency will result in accelerating collections, allowing the company 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.

GEPCO billing, collection and financial transfer procedures are common business practices for a manual system that would be effective for recorded transactions if followed. Adding new technology and revising the procedures for the additions would streamline the billing cycle and reduce errors.

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 GEPCO 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. However, if subdivision management were to focus on areas where losses are highest, making a concerted effort to

audit meter readings at delivery points, this would support an effective loss reduction program. An effective energy accounting initiative would not only result in lower administrative losses, it would also result in higher billings leading to more income to the DISCO.

Losses are incorrectly calculated for feeders. The deliveries are calculated on the calendar month. Billed amounts are based on the billings for the same calendar month, but the consumption has occurred over a two month period due to the staggered billing cycles. Although deliveries and recoveries are 30 days each, they are not the same 30 days, so the losses can fluctuate wildly with the changing seasons.

Improved consumer service

Although attempts are being made to improve consumer service, the programs have not yet proven significantly effective. There is need to educate the employee on the importance of the customer as a client & business partner. 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 personnel have limited authority to clear complaints, requiring the consumer to make repeated visits to the consumer service center to resolve issues that may arise.

Recommendations

In order to achieve improved commercial performance, a number of interventions will be required that are related to one another. Improvements in metering technology from changing 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 & 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 a systematic and coordinated fashion, should result in increased revenue recovery, improved commercial efficiency, and enhanced consumer service:

1. Implementation of consumer census to verify/add consumers.
2. Installation of a Customer Information System.
3. Reorganization of company's corporate structure so that all commercial units report to the Director Consumer Services.
4. Update metering, using advanced metering 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 repair, testing, and calibration.

3.5 HUMAN RESOURCE MANAGEMENT

HR policies and procedures have remained static for the past two to three decades, and currently do not support GEPCO's needs to attract and retain highly skilled, dedicated, and engaged employees. Staff at 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. It will need to be ensured that GEPCO is fully involved in the development of policies and procedures, so that changes are readily accepted.

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

The principal changes that are necessary have to do with the compensation package, the hiring and promotion program, and the performance management program. As mentioned in the previous chapter, the fundamental changes will need to occur in redefining position 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 GEPCO in line with best practices, but this issue will require and will receive significant additional analysis before final decisions are made.

Increasing the salary 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 GEPCO management and board priorities, whereby employees know, appreciate and accept the new corporate culture; and where good performance becomes a clear criterion for recognition.

Recommendations

1. Develop a performance management program, together with revised post descriptions, setting goals & objectives for all staff positions; and establish a mid-year and annual evaluation review process, measuring employee performance, and rewarding them based upon performance.
2. Modify the hiring policy to ensure an objective, transparent and unbiased recruitment process.
3. Revise the compensation and benefits package, making it attractive and competitive; a detailed market study will be required to devise, and select an effective methodology for its presentation to DISCO personnel. For instance, the new higher package could be offered only to those employees opting to accept the new performance based terms & conditions of employment etc.
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 highly valued by employees.
5. Build further on the existing human resource information management system (HRIS) to enhance data and reporting capability, as well as the level of IT in the training facilities.
6. Review and revise GEPCO's benefits 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 a staffing plan to reduce staffing levels in conjunction with outsourcing and reduction through an 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 providing structure, incentives, and discipline for all line staff employees; ensure that linemen are provided with and required to use proper clothing and safety gear while performing construction and maintenance tasks. Design and deploy safety & awareness outreach campaigns for its consumers. It will be GEPCO's professional & social responsibility to extend the safety message to its personnel and public both.

3.6 COMMUNICATIONS AND OUTREACH

It was observed during the assessment that too little has been done at GEPCO to promote modern communications culture at the organizational level, resulting in the persistence of highly inefficient and non-productive internal communications practices.

With limited in-house autonomy and a consistently low popularity graph among external stakeholders due to chronic power shutdowns, tariff increases and an aging distribution system, the company faces the complex challenge of building its corporate image.

The following recommendations are outlined:

1. Develop a comprehensive communications strategy to transform internal and external communication policies & practices through a well-conceived and targeted action plan, with allocation of resources and timeframe for implementation.

2. Develop an external corporate communications manual for promoting an independent and progressive brand image of the company.

3. Strengthen and support the PR Department, enabling it to plan and undertake extensive communications & outreach activities with various stakeholders in a targeted manner. These efforts should be directed at transforming and promoting GEPCO's public image as a progressive and efficient corporate service provider.

4. Prepare and implement a plan to promote ICT-enabled correspondence, records keeping and information management as per internal communications strategy, to move beyond the current status quo of outdated practices.

5. Develop an Annual Calendar of outreach activities for consumer awareness and corporate brand building. Integrate these with issues of theft control, energy conservation, etc. Themes of Corporate Social Responsibility (CSR) and brand equity should be regularly promoted in the local mass media through a series of planned public outreach activities. Seminars, public dialogue, press shows, radio talk shows & collaborative events are a few examples of activities to be carried out on a regular basis.

6. Develop a plan to upgrade Customer Service Centers with a corporate outlook, create an ICT-enabled environment, impart training to develop a dedicated staff, and display consumer information material such as posters, brochures, etc. to ensure friendly & efficient customer service.

7. Provide an intranet facility for improving the efficiency of internal communication, facilitation of knowledge sharing.

8. Appoint a dedicated web-master to upgrade and maintain the web page as an interactive web portal for internal and external stakeholders.

APPENDIX: AUDIT METHODOLOGY

A.1 OVERVIEW OF DATA COLLECTION AND PROCESS ASSESSMENT

The operational PDIP audit process was designed to facilitate data collection and evaluation of engineering, financial, commercial, human resource information and data in collaboration with utility management. The objective of this activity was to evaluate performance efficiency through performance & process analyses, and collecting information by one-on-one interviews with company management and employees. The PDIP team 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 and delivered, revenues collected, and delinquency notices delivered. For a program aimed at measuring commercial, financial, administrative, and technical performance, review of key processes like the revenue collection cycle is extremely important.

The Operational Audit for GEPCO followed an identical process to audits undertaken at the other seven DISCOs. Data was collected and evaluated for four areas of electric distribution operations:

1. DISCO governance
2. Organizational structure 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 require improvement, while comparison of best practices allowed the PDIP team to identify high impact performance interventions.

A.2 GOVERNANCE

In addition to reviewing operational activities, the PDIP team l reviewed DISCO governing board policies, procedures, and practices. With the recently increased GOP emphasis on instituting greater operational independence in the DISCOs, it was essential to evaluate the changes needed to support board composition, qualifications, training, and other characteristics.

Towards this end, the PDIP team reviewed/analyzed the following documents and board actions:

1. DISCO by-laws that establish board selection processes, scope of authority, and overall board 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 and tenure, and process of removal (if warranted).
5. Board Membership qualification requirements.
6. Training/orientation provisions for new Members.
7. Periodicity of Board meetings, and provisions for extraordinary meetings.
8. Fee structure – are 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 to assess the efficacy of its institutional capacity for managing its human resources, physical assets, and business systems. The following organizational evaluations were undertaken and issues examined:

1. Analysis of organizational design & structure.
2. Review of DISCO departments and divisions.
3. Review of key managerial positions and post descriptions.
4. Assessment of managerial and functional competencies.
5. Review of organizational chart & recommendation of 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 and 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 and a visual review of quality of construction
- Meter security and vulnerability to tampering
- Operations practices and adherence to established policies and procedures
- 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 was 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 more than 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 can survey in the time period allocated.

Once the 11kV feeders were chosen, a total of no more than 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. Milsoft Windmil 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, but 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 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. Because of 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 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. The Distribution Standards 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 the operational audits, key financial parameters were identified for inclusion in the data collection and analysis process. These include: financial reporting, internal control, cash receipts and disbursements, operational financing, and investments & cost containment.

This audit comprised 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 company policies, procedures, & operating practices. From these discussions, the PDIP team identified operational objectives, expected financial and controls, and key risk areas.

DISCO practices/procedures were evaluated for financial performance parameters; variance between industry and utility practice/performance noted & reported; and procedures used to test each financial control to verify 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 audit team worked as a single unit at LESCO to ensure all its members gained the experience and understanding of the assessment process, and to adjust this process for other later DISCO audit processes.

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

Tools

The team reviewed utility organizational policies & procedures, Annual Report, accounts' systems, and management/employee interviews. 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 evaluations of financial management processes, management of banking functions, management of cash & receivables, internal control processes, and DISCO overall management of financial performance. Results of these analyses were presented in the form of data tables, performance ratios, and discussions of specific issues not lending 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 this audit was on the revenue cycle which included the registration of new consumers, meter reading practices, bill production and delivery, and 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 to identify opportunities to increase the efficiency and transparency of commercial activities, and improve the financial performance of the DISCOs. Opportunities specified 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. This team comprised 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 per activity and the time required for each were obtained from the relevant department heads. These were verified by observing the practices at selected revenue and district offices and pay points.
The commercial management team also collected billing/collection/consumer data from the billing system. This served not only as a baseline reference to gauge future results, but to provide an indication of the time taken to complete the revenue cycle. Other hard data collected during the interviews included the number of meter reading routes, actual number of meters in a route, frequency of meter tests & calibration, customer billing complaints, and number of employees involved in the revenue cycle.

Strategic Analysis

Once the data collection process was complete, the team members evaluated the data and DISCO commercial practices/procedures to determine the changes needed to improve their transparency, cost recovery and effectiveness. of the commercial procedures and 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 interaction between departments. These maps were reviewed for redundancies and possible internal control weakness eg. lack of segregation/coordination of duties/activities. They were studied to determine whether data flow was efficient, or where interventions would facilitate cost reductions, increased revenues, and accelerated cash flows.

The interventions identified consisted of a combination of investments in secondary distribution systems, transformers, services, and revenue meters; plus changes in commercial system practices & procedures to improve company metering and revenue recovery practices. The procedural changes require the addition of devices to eliminate transcription errors, speed the data entry, and increase internal controls. The Commercial Specialist also evaluated and made recommendations regarding the effectiveness and

adequacy of commercial software (the CIS), to determining if a software solution more effectively integrating 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 was the evaluation of human resource management and HR systems for each DISCO. This review evaluated DISCO organizational structure, analyzed performance management systems, evaluated compensation systems, reviewed selected management and staff positions; and performed a preliminary analysis of its training needs, specifically focusing on commercial needs and linemen training to enhance both productivity and safety. The HR audit was led by the Organizational Specialist, assisted bya team of Pakistani HR and institutional management (IM) experts.

The goal of this audit was identifying improvements needed in DISCO organizational structure and human resource management to result in an HR model supporting the company's long-term institutional requirements. The model should establish appropriate levels of compensation and benefits, and a work environment with the incentives for a motivated & productive workforce. It should encourage a process-centric culture; and a cost delivery model balancing efficient customer service with effective service delivery, the twin goals of successful utility function. The assessment therefore focused on assessing not only organizational structure and key processes, but also on HR management/performance & systems, organizational structure, responsibilities, and functions;, on the current roles of line managers and their staff managers; and on the compensation packages.

The evaluation compared DISCO HR management and its systems with best practices from within and beyond Pakistan, from which recommendations were made for improved policies, practices & procedures to enhance utility productivity and environment. The team used diagnostic tools to identify gaps in optimal DISCO personnel performance. Data was collected through interviews and surveys for baseline of current policies/practices; this was contrasted with best practices to define the actions necessary through implementation of the Performance Improvement Action Plans for significantly improved HR operation and management.

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 company'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 assess roles and responsibilities, adherence to existing procedures including health and safety, and any other standard operating procedures existing within the Discos' ambit.

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. Examination of 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 gaps in critical skills & competencies. This shall be translated into an urgent training program launch in the intervention project phase.
3. Identification of essential & immediate training needs for engineering, financial management, commercial management, and human resource departments.

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 the relevant staff
7. Assessing the current practice of using various communication tools/vehicles like web site, 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, improve capacity of the communications-related staff and strengthen the effectiveness of its communications department.

Ultimately, the recommendations will contribute towards positioning the DISCO as a service-delivery and customer-centric corporate entity.

Internal Communication

Internal Communication is related to the communication within the DISCO. It could be between individuals, between different departments or between individual and department. The assessment helped map internal communication process, feedback and follow-up status to assess suitability and efficiency of the existing system and procedures.

External Communication and Outreach

The analysis of external communication determines the extent of activities carried out for corporate image building to serve as entry points for keeping a liaison between the organization and its relevant stakeholders, including extended audiences. Promotion of a strong corporate culture and coherent brand identity through appropriate choice of communications tools, processes, media mix, supporting budget and follow-ups are areas that deserve careful 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 Staff Members Interviews

In-depth interviews with the key informants in the DISCO 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 and access to information. Issues relating to existing penetration of Information and Communication Technology (ICT) and current practices of knowledge management were also discussed. Deliberations also focused on strategic efforts to develop corporate brand image with external stakeholders to spell out a coherent communication strategy for the company. The existing activities of outreach and potential of such activities was also discussed.

Besides key informant interviews, questionnaires were also filled in by relevant senior officers of the DISCO on corporate, external and internal communication and outreach activities of company.

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