USAID
FROM THE AMERICAN PEOPLE

PAKISTAN-US ENERGY PARTNERSHIP

PESHAWAR ELECTRIC SUPPLY COMPANY (PESCO) OPERATIONAL AUDIT REPORT

Produced by:

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

APRIL 2011

PAKISTAN-US ENERGY PARTNERSHIP

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

PESHAWAR ELECTRIC SUPPLY COMPANY (PESCO) OPERATIONAL AUDIT REPORT

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

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

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

TABLE OF CONTENTS

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

For a major electric distribution utility like Peshawar Electric Supply Company (PESCO), 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. Audits covered governance, operational, financial, human resources, communications and customer service areas and surfaced opportunities for fundamental improvement in all areas. 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 performance improvement projects to demonstrate a number of key operational improvements and directly measure their value to the utility.

- PESCO 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.

MAJOR FINDINGS & CONCLUSIONS

The operational audit conducted for PESCO during Component 1 provided extensive insights into how PESCO operates and the performance consequences of the company's current approaches and practices. The PDIP team also became acutely aware of deficiencies that obstruct progress toward improvement. Part of the challenge faced by PESCO's management and board in seeking to 'bootstrap' overall performance, enhance customer service and create greater financial self-sufficiency will be to select the *right* actions at all levels, from

front-line operations to strategic planning, and assign the *right* priorities. This summary of major findings culled from the operational audit findings contained throughout this report is intended to provide a starting point for management consideration.

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

GOVERNANCE	PESCO'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 towards greater professionalism and operating autonomy; however additional changes will be required to enable the Board to exert the strategic influence the company will need to succeed in the restructured Pakistani power sector and to improve the company's operating and financial performance to more acceptable levels.
ORGANIZATION	PESCO's current organization is structured primarily by geographic area and not along functional lines as seen at most modern electric distribution utilities worldwide. Commercial functions responsible for cash flows within the utility should not report to Superintending Engineers whose responsibilities focus on power system stability and reliability. The current arrangement also creates potential conflicts of interest in the performance of key jobs within the utility.
ENGINEERING	Planning is a serious deficiency in the PESCO system, used generally to address immediate system performance issues, not to plan for future load growth. PESCO has high loss levels that threaten the Company's long-term viability. Preliminary loss analysis on a sample of four feeders using GIS mapping and modeling technique with load flow software shows technical losses of PESCO as 13.4%. High technical losses are attributed the long and overloaded 11kV circuits as well as undesirable HT/LT line length ratio. Comparing measured technical losses with reported distribution losses of 34.1% for the year ended on June 30, 2010, leaves 20.7% as the administrative losses. Non-technical losses are excessive due to poor meter security lack of a meter testing program, and theft through illegal hooking. Losses will need to be brought under control in the near future to ensure long-term financial sustainability and viability. Construction and maintenance work practices in widespread use among PESCO employees are inconsistent, rely on makeshift and stopgap approaches and suffer from lack of available equipment and transportation access. Thirteen linemen were killed last year due to unsafe work practices and many more were injured.
FINANCIAL	PESCO has been unable to collect more than Rs 22.5 billion due from the Tribal Area Electric Supply Company Limited (TESCO) for wheeling charges. The most recent financial audit indicates PESCO has not recognized the liability for electricity sold by CPPA to TESCO. The tariff rates for the AJK Government are required to be determined by the Standing Sub Committee constituted for tariff determination and below the NEPRA determined tariff. The GOP filed petition on behalf of the

	Government of KP has prevented PESCO from increasing consumer end tariff for the last two years. The collection rate for government clients is 53.8%. Enterprise Resource Planning (ERP) systems offer the opportunity to convert manual business and distribution operating systems to electronic, computerized management systems. This will be important as PESCO transitions into customer information and billing systems, geographical information systems (GIS) and applications. PESCO's cash flows are impacted significantly 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. 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	The shortage of meters and the lack of support from the civil authorities affect the ability of PESCO to operate as a viable utility. New connections are delayed; defective meters remain in use; disconnection for defaulting and illegal consumers is difficult at best. The lack of security in certain areas affects customer service. The lack of service decreases the willingness to pay. Commercial procedures are defined in a logical fashion, but are not effectively practiced. Moreover, the policies and procedures have not kept pace with changes in technology; rather than using electronic data collection and transfer, PESCO relies on manual procedures augmented with a 1960s COBOL program for bill processing. The outdated billing program and manual procedures makes the revenue cycle inefficient and lacking in transparency. The meter reading practices currently employed are subject to influence by the 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. The commercial performance of PESCO is seriously lacking in terms of high non technical losses of 20.7% coupled with poor collection efficiency from the private customers that has led to the accumulation of arrears of Rs. 27 Billion, highest in all the DISCOs, which is equivalent to 306 days of billing posing a serious threat to the financial viability of the company. Recognizing the fact that many areas of PESCO are affected by War on Terror, yet the performance in settled areas is also lacking.
HUMAN RESOURCES	PESCO suffers from human resource management inadequacies that reflect the status quo in all Pakistan DISCOs. That is, it employs WAPDA legacy human resource practices that recognize seniority rather than performance, and that do not adequately provide for fair and transparent hiring and promotion policies. Staff demographics indicate that a very high number of PESCO employees have not been assigned to definite positions in the utility, leading to the

	conclusion that the employees do not serve the core purpose of the Company. The utility is by any measure overburdened with under-performing employees, and would benefit from a program aimed at reducing employee levels. PESCO corporate culture is akin to that of a government agency in which lifetime employment without performance expectations is balanced by low salaries. This environment makes it difficult for the company to recruit skilled candidates for open positions because the best candidates command higher salaries in private industry. As a consequence, PESCO is both overstaffed by any reasonable benchmark, and under-resourced, with serious shortages of employees possessing the right mix of technical training, experience and motivation to accomplish its mission. Moreover, the corporate culture requires a complete overhaul to instill in all employees the strategic message that quality of work, professional dedication & integrity, loyalty to the company, responsiveness to customer service, and constant attention to safety are among the company's core values.
COMMUNICATIONS & OUTREACH	PESCO is following the outdated and tedious communications practices of its predecessor organization, which involve extensive and laborious processes and paper pushing. Use of information technology as a communication tool is very low. All mass media campaigns are carried out by PEPCO. PESCO's role in external communication is limited to local public relations activities such as public announcements, procurement and shut down notices and occasional messages for energy conservation. Customer satisfaction is hampered due to reliance on untrained staff substitutes from the field, manual working methods and lack of networking at service centers. Consumer outreach is minimum, resulting in a communication disconnect with the end consumer about the actual role of the DISCO. Moreover, PESCO is confronted with the enormous challenge of power theft and volatile consumer culture requiring consistent communication efforts to cultivate a responsible consumer behavior.

Table 1 Key Finding from PESCO Operational Audits

KEY RECOMMENDATIONS

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

GOVERNANCE	The Board of Directors should become PESCO's independent governing body with ultimate decision-making authority. The Board should be empowered to: 1. Set company policies, performance objectives and strategic directions. 2. Adopt bylaws 3. Appoint members to its advisory, executive, finance and other committees 4. Hire, monitor, evaluate and fire the CEO and senior executives
ORGANIZATION	A thorough review of organizational structure should be undertaken to evaluate organizational changes required to improve PESCO'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 day-to-day 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 which holds the promise of improving many areas of engineering performance is to develop a GIS for the entire PESCO service territory and to link the GIS with engineering software to develop long-term system planning capability. This would allow PESCO to perform detailed short- and long-range work plans, identify loss reduction targets and expand service capacity where and when necessary.
FINANCIAL	PESCO's greatest financial vulnerability is its poor cash flow position resulting its inability to pay for the power purchased from CPPA. In addition, the a new financial framework is needed that should include: 1. Beginning preparations for design and implementation of an ERP platform with e-applications to serve all finance, accounting, commercial, human resource needs in line with control, management, and financial reporting to the PESCO Board of Directors, National Electric Power Regulatory Authority (NEPRA), and the Ministry of Water and Power (MWP) as needed. This would include developing an in-house IT support structure which would accommodate the service needs of the organization. 2. Updated accounting and internal audit procedures that more effectively serve the needs of the Board of Directors. 3. Improved transfers from external pay points to PESCO bank accounts. 4. Insurance coverage for buildings, equipment, inventories and other assets as deemed necessary to eliminate exposure to significant financial loss.
COMMERCIAL	PESCO's greatest financial vulnerability centers on low revenue recovery due to high non-technical losses – specifically due to high theft and poor commercial practices. A number of vulnerabilities in PESCO's revenue cycle require immediate and comprehensive attention. The lack of metering is a major cause of unaccounted for energy. Improvements in metering, unless organizational and procedural changes are made in the meter reading auditing process to detect fraud or manipulation of the data, will be of limited value. Implementation of a Customer Information System (CIS) will require new accounting, data collection and transfer and billing procedures. Commercial management is the fulcrum of successful electric distribution utilities; if commercial practices and procedures are not carefully designed and implemented with discipline and integrity, the financial viability of the utility will be at risk. The following, if implemented in a systematic manner with discipline and integrity, will aid PESCO in becoming a viable and financial sustainable utility.

	1. Metering, using automated metering technology where appropriate. 2. Enforcement of meter reading audits and meter inspection programs. 3. Reorganized meter reading routes. 4. Corporate reorganization so that all commercial activities report to the Director of Consumer Services. 5. A consumer census to verify/add consumers. 6. Installation of a new Customer Information System. 7. Implementation of energy accounting. 8. Design of more comprehensive customer service and consumer awareness programs. 9. Establishment of a program of systematic meter testing, repair and calibration. 10. Establishment of an effective mechanism to manage recovery of huge receivables especially from the private customers at the earliest.
HUMAN RESOURCES	PESCO needs to improve its human resource management system to meet the current challenges by taking series of measures including but not limited to the following: 1. Develop a performance management program, together with revised position descriptions, setting goals and objectives for all staff positions; and establish a mid-year and annual evaluation review process, measuring employee performance and rewarding employees based upon performance. 2. Modify its recruiting policy to ensure an objective, transparent and unbiased recruitment process. 3. Revise the compensation and benefits system and package, making it attractive and competitive; a detailed market study will be required to devise a new package, and select an effective methodology whereby the new package is introduced in the DISCO. For instance, the new higher package should be offered only to those employees opting to accept the new terms and conditions of employment, including performance levels etc. 4. Develop training and development culture and programs; and upgrade current training facilities (Regional and Circle Training Centers). This will have the effect of making training attractive and more highly valued by the employees. 5. Introduce more advanced information technology for use in Human Resource management, as well as in training facilities.
COMMUNICATIONS & OUTREACH	A utility-providing organization needs to have a strong and integrated communications and outreach program. It is recommended that PESCO should: 1. Develop and implement a comprehensive communications and outreach strategy for effective internal and external communication. 2. Strengthen the PR department with a larger role and a regular budget to develop mass media campaigns, consumer advocacy and outreach activities. 3. Prepare and implement an IT culture for fast and efficient communication by computer-enabled database/knowledge management, intranet and capacity development of its workforce. 4. Develop an annual calendar of outreach activities for consumer awareness and corporate brand building. Integrate consumer outreach activities with issues of theft control, energy conservation, etc.

	5. Improve service delivery of Customer Service department by consumer-centric and gender-sensitive action plans, training and development of staff. 6. Conduct consumer outreach and awareness campaigns to educate the end consumer about the role of PESCO and inculcate a sense of responsibility among consumers to gradually transform consumer behavior to control electricity theft. Implement a monitoring and evaluation plan for staying abreast of changing communications needs.

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 PESCO faces today, the report lays bare what is wrong and what should be considered by PESCO management to fix it. The obvious downside of trying to address these problems is that the "forest 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 a strategic plan for PESCO, adopting long term goals and ensuring that all employees understand them will create a shared awareness and, even more importantly, shared accountability. Every employee should know what is important to the company, where improvement is needed, what they can do to help and how progress will be measured. Without a strategic plan, it is hard to imagine how management can succeed in addressing the problems highlighted in this report, many of which have persisted for decades. A small number of long-term goals typically form the basis of 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

PESCO 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 utility statistics which are generally available. 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 PESCO improving its operating performance and becoming financially self-sufficient. These may include complacency or unwillingness 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 PESCO and overcoming them will be critical to success.

Appropriate Use of Technology

PESCO'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 its 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 PESCO 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 how to use new systems and adapting their work flows to take full advantage of technology. Familiarity with computers, local area networks and common desktop software is severely limited. Procedures that accompany technology-enabled business processes, e.g., backups and system modifications to ensure their robustness may be unfamiliar territory. In the short term therefore, emphasis should be on widely proven technology solutions that automate manual processes, especially in 'back-office' systems such as customer information. 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 PESCO's case, nothing short of a dramatic change in corporate culture will be needed. All employees must feel that they are valued corporate assets in whom investments such as training will be made and whose welfare is considered vital. Leading utilities around the world empower their employees to identify problems, help devise solutions and receive recognition and rewards for doing so. These global leaders in the power sector have created cultures in which continuous improvement of work practices is the responsibility of every employee and no problem is too small to receive specific attention. Empowering PESCO'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, PESCO 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, long overdue experience.

HOW THIS REPORT IS ORGANIZED

The main body of this report is organized in a way that is intended to highlight current challenges PESCO 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 PESCO 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 a three-year duration. PDIP was designed to be implemented in two distinct Components, operational audits at each of the eight Government-owned distribution utilities (DISCOs) and definition 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 to demonstrate a number of key 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 Pakistan Power Distribution Companies

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

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

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

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

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

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

1.1.2 Purpose of Operational Audit and Improvement Action Plan

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

1.2. PESCO Profile

Peshawar Electric Supply Company (PESCO) is a wholly-owned government distribution company with headquarters located in the city of Peshawar, the provincial capital of the province of Khyber Pakhtoon-khwa[KP]. PESCO is responsible for supply of power to all the districts of the province. It has boundaries adjoining IESCO and FESCO in the east and QESCO in the south. The territory is spread over about 74,521 sq. km.

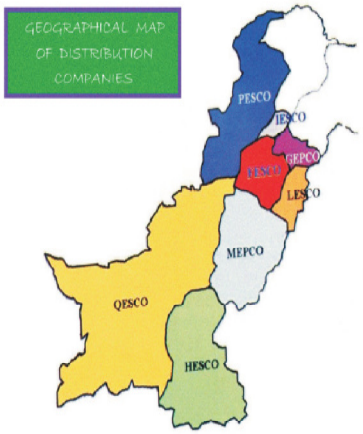


Fig. 1a: Location of DISCOs

Source: NEPRA Industry Report 2009

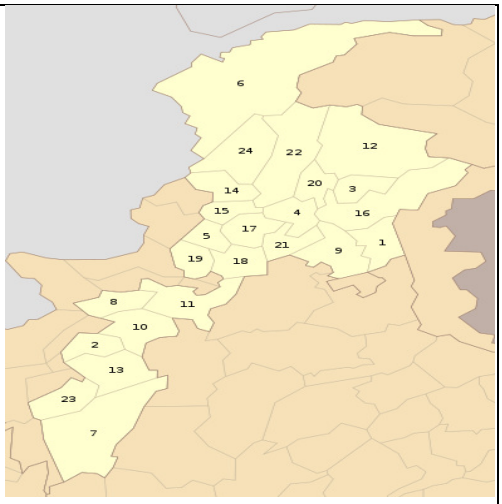


Fig. 1b: Service Territory of PESCO

Source: Wikipedia, January 2011

PESCO is divided into 6 Circles, 30 Divisions and 143 Subdivisions. 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). Initially, PESCO was also responsible for supplying electricity to tribal areas but now that function has been taken over by the Tribal Areas Electric Supply Company (TESCO).

TABLE 1.1: PESCO CHARACTERISTICS

No	Description	Value
1.	Administrative Districts Served	25
2.	Service Area (km²)	74,521
3.	Operation Circles	6
4.	Operation Divisions	30
5.	Operation Sub-divisions	143

General description of market

As of 30th June 2010, PESCO reported over 2.5 million registered customers. Approximately 88% of these customers are domestic. The other predominant category is commercial, comprising more than 10% of customers. The industrial customers totaled less than 1% of all customers served.

TABLE 1.2: PESCO CUSTOMER DISTRIBUTION AS OF 30TH JUNE 2010			
No.	**Customer Class**	**Customers**	**Customer Mix %**
1	Domestic	2,225,806	87.76%
2	Commercial	259,127	10.22%
3	Industrial	23,112	0.91%
4	Bulk Supply	865	0.03%
5	Tube wells	26,372	1.04%
6	Other	869	0.04%
	Total	**2,536,151**	**100.00%**

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

Reported sales by customer category vary widely from the distribution of consumers. PESCO's primary clientele is domestic consumers accounting for 59% of sales while commercial and industrial consumers have 7% and 21% shares of sales respectively. Sales to bulk supply consumers' amount to about 7.5% while those to agricultural consumers (tube wells) are about 4.5%. Table 1.3 provides a summary of sales by consumer category.

TABLE 1.3: PESCO SALES FOR 2009-10			
No.	**Customer Class**	**Sales GWH**	**Proportion %**
1.	Domestic	3,867	59.47
2.	Commercial	464	7.14
3.	Industrial	1,372	21.10
4.	Bulk Supply	485	7.46
5.	Tube wells	291	4.48
6.	Other	23	0.35
	Total	**6,502**	**100.00**

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

Statistical summary, comparison with other DISCOs

The performance indicators for which statistical data was provided include total losses, unplanned outages, transformers burnt ratio, new connections achievement and bills adjusted.

TABLE 1.4: PESCO 2010 KEY PERFORMANCE INDICATORS		
No	**Description**	**Value**
1	Transmission & Distribution Losses	37.1%
2	Outages	
	Number of Outages	163,041
	Total Outage Time in Hours	125,929
	Hours per Outage	0.772
3	Transformer Failure (% MVA)	4.8%

PESCO holds about 13% of the electricity distribution market in Pakistan in terms of number of customers but accounts for 10% of total energy sold in Pakistan while contributing only 6% to the total revenue collected. The utility's HT and LT network is about 11% and 21% of the total length of HT and LT lines respectively. The transformer capacity is 12%, nearly in the same proportion as the share in number of customers. PESCO is responsible for about 10% of the allocated load and 13% of total non-coincident peak demand of all the DISCOs.

TABLE 1.5: PESCO FY 2010 STATISTICS

Description	All DISCOS*	PESCO	Share (%)
Customers	19,582,224	2,536,151	12.95
Sanctioned Load (MW)	47,855	4717	9.86
Non-Coincident Peak Demand (MW)	19,288	2,487	12.89
Energy Sales (GWh)	63,660	6,502	10.21
Employees	122,530	17,972	14.67
Revenue (Million Rs)			
- Billed to Customers	488,022	38,016	7.79
- Collected from Customers	517,055	32,479	6.28
Receivables from Customers			
- Private	103,351	27,005	26.13
- Government	58,026	1,426	2.46
Total	161,377	28,431	17.62
Distribution Network			
- HT Line (km)	279,990	31,284	11.17
- LT Line (km)	205,020	42,526	20.74
- Dist Trans Capacity (MVA)	32,524	3,956	12.16

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

While PESCO as a whole may not appear to be a high performer from the statistical presentation above, performance varies by geographic location within the PESCO service area. There exist islands of relatively better performance. For example, in Hazara region losses were around 12% and the revenue recovery rate was also high as compared to other circles of PESCO. Such performance, if replicated across other circles in PESCO, will contribute to significant performance improvement.

The purpose of this report is to explore PESCO's operating practices and procedures, to identify functional areas where performance improvements are needed and can be implemented, and to document the specific policies, procedures and operational practices that will need to be improved to contribute to lower operating costs, and improved overall financial and 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 PESCO 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 PESCO 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 PESCO to understand how the Board was configured and to assess the level of independence, autonomy, and authority vested in the Board. Key findings and analysis of that review are presented in this section of the report. On November 22, 2010 all DISCO Boards were dissolved by order of MWP, rendering many of the PDIP observations no longer germane. 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 PESCO's corporate governance:

- PESCO's Board has not yet 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 that there is little evidence of strategic issues being addressed in Board meetings.
- Declaring its intention to reduce the influence of the government in DISCO governance and move DISCOs toward greater operating independence, MWP recently dissolved the PESCO Board, appointing a new Board in its place.
- The newly nominated Board should present an improved 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 PESCO 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 of the BOD that is 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 orient board members towards the annual general meeting of shareholders and must take place within four months after the end of the fiscal year. The Board has not developed any of its own policies specific to the governance of an electric utility in general, nor to PESCO in particular, relying on the requirements of the Companies Ordinance 1984 and the Articles of Association of PESCO.

PESCO's BOD has chosen to meet on a quarterly basis as required by the Code of Corporate Governance although these rules are only applicable to listed companies in Pakistan. Review of the Board minutes

indicates 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 precisely the topics for its consideration.

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

- The appointment and evaluation of the performance of the Chief Executive Officer is perhaps the single most important BOD function in most corporations, but the CEO of PESCO has historically been appointed by PEPCO.
- Similarly, the entire senior executive cadre of the company is appointed by PEPCO rather than being selected by the CEO or recruited by the PESCO HR department.
- Board members nominated from government agencies were senior in position, and therefore senior in chronologic age, resulting in short board tenures and high turnover.
- The BOD has not been able to form the Board Audit Committee.

In an effort to understand just what powers the BOD actually has, the Book of Financial Powers (BFP) was reviewed and discussed with the its Secretary who is also PESCO's Finance Director. The BFP is the document governing board functions and as such was approved by the Board. This document establishes various approval authorities and monetary limits for financial transactions and certain other actions taken by PESCO's management and BOD in the operation of day-to-day activities. The utility has prepared a draft of proposed changes to the BFP to address more efficient approval authorities and adjust monetary limits to reflect the current financial environment. These proposed changes were made with regards to maintaining high corporate, governance and internal control standards. This proposal was made in 2008 but has been delayed pending approval by PEPCO. It was the conclusion of the PDIP team that the PESCO BOD had relatively little authority over the management of PESCO and could not be considered a true corporate board.

As noted in a decree from the Ministry of Water and Power (MWP) dated 22 November 2010 all DISCOs, GENCOs, and NTDC BODs were released from service on the DISCO boards. The order stated the intention to reconstitute the BODs "on professional lines" in accordance with the guidelines of the Cabinet Committee on Reforms with special emphasis on representation from consumers. Significant effects of the change include:

- The majority of Directors must come from the private sector.
- Ministers/Secretaries/Government officials may not be nominated as Chairmen of the BOD.
- Representation from the administrative Ministry/Division on the DISCO Boards be restricted to one.

This is clearly an action intended to reduce the influence of Government in the governance of the DISCOs. The notification should be considered a definitive step towards establishing the DISCOs as more independent public corporations.

In an order by PEPCO dated December 23, 2010 the BOD of PESCO has been re-constituted. 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, it also acted as an authority on any proposed new positions at the DISCO. This was a role the

company assumed during a transition period after DISCO formation and never relinquished. DISCOs must be empowered to manage their own manpower requirements.

2.2 ENGINEERING AND OPERATIONS

2.2.1 Overview

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

Peshawar Electric Supply Company Ltd. (PESCO) is a Public Limited Company incorporated in April 1998 as an electricity distribution company with jurisdiction in Khyber Pakhtoonkhwa & the Federally Administrated Tribal Areas (FATA). In July 2003 FATA was detached from PESCO and became an independent utility as TESCO, but to date all technical services are being provided by PESCO. In practical terms PESCO is still the utility company serving almost the entire KP province with a total of 2.5 million consumers having 4 % annual growth. Geographically, it serves the remote mountainous areas with 6 operation circles, 30 divisions and 143 sub divisions with almost 31,284 km of 11kV distribution line, 42,526 km of LT lines, 1,919 km of 132kV line, 861 km of 66kV line and 311 km of 33 kV transmission lines through 87 grid/substations. Peak demand for FY2009-10 was 2,487 MW and purchases were 10,330 GWh, with an aggregate Transmission & Distribution loss of 37.1 %.

Approximately 60 % of PESCO's sales are to domestic consumers against around 21 % to industrial customers through 11 kV distribution network. PESCO does not use its 33 kV system for distribution.

2.2.2 Summary of Key Findings

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

- **Network—P**ESCO's transmission network, is extensive and has a significant amount of 66kV and some 33kV lines. Losses are at approximately 4.5% are high, and service quality no doubt marginal. PESCO's transmission system is not a significant contributor to total system losses or a drag on overall financial performance. However, a closer focus on managing the company's transmission assets might yield additional funds for investments in distribution.

- **Losses—**Current estimates of transmission losses appear to be reasonable in that they are consistent with modeled values. Loss levels in the distribution system are extremely high and will require significant effort and financial investment to achieve 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 PESCO for use. This type of load forecast is widely recognized in the industry to have very low usefulness as it cannot reflect changing conditions or economic conditions. Moreover, five years is generally 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 appropriate end-use or econometric forecast were being collected.

- **Feeder mapping**—Feeder mapping is not carried out on a systematic basis. Each operations subdivision has its own single line drawings of the feeders in its territory, but no geographic maps exist anywhere in the company.

- **Feeder analysis software—**The software used by PESCO for feeder analysis is outdated and lacks many of the features found in contemporary distribution analysis software such as direct input of Geographic Information System (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 address congested area construction very well, and this is a problem in some urban areas serviced by PESCO.

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

- **Safety**—Thirteen (13) linemen lost their lives while performing company work during the 2009-10 fiscal year. Improved work practices and safety policies would reduce this number and alter perceptions among the workforce that distribution maintenance and repair work is too dangerous to perform.

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

- **Procurement**—PESCO conducts a large number of procurements annually, often for relatively small amounts. Also, procurement practices that are non-standard effectively preclude international companies from bidding, unnecessarily narrowing the competitive field and inhibiting potential savings. PESCO procured an unusually large amount of materials in 2009-2010 due to heavy flood damage sustained in the province.

Distribution feeder mapping and loss segregation: Here are the key findings of the review of feeder mapping and segregation of technical versus commercial losses:

- Detailed modeling of distribution system losses indicates that technical losses on PESCO's system should be approximately 13.4% of annual energy (kWh).

- In contrast, PESCO reported total system energy losses of 37.1% in the 2009-10 fiscal year. If transmission losses were 4.5% as PDIP estimated, the distribution component of loss would be 32.6%. The difference between the distribution technical losses of 13.4% and probable total distribution loss of 32.6% is a non-technical (commercial) loss of 19.2%. This figure is likely to reflect large-scale meter tampering, illegal line taps and meter reading fraud aided and abetted by company employees.

- **Accordingly, a strategic opportunity exists for PESCO 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 city of Peshawar, no activity is underway to evaluate any changes in standards for this purpose.
- PESCO would benefit from application of covered LT systems, such as multiplex or ABC, as a means of reducing outages, public safety hazards, and energy theft.

2.2.3 Analysis & Discussion

Transmission System Management Assessment

Initial visits indicated that the transmission system, while heavily loaded, and no doubt in need of improvement, is providing adequate service. PESCO has a transmission network of 1,919km of 132kV, 861km of 66kV and 311km of 33kV lines totaling 3,091 km, receiving power from NTDC through one 500kV and three 220kV substations. PESCO operates 87 grid substations, with fifty-nine 132kV, eighteen 66kV and six 33kV substations. System peak demand is 2,487MW, a figure that is somewhat suppressed by load shedding.

PESCO prepares a five year plan covering the requirements of the 132kV and 66kV transmission system, using PSS/E, widely utilized power flow software, to model the system. Total expenditures for the transmission network (STG) amounted to RS 1,480 million, as opposed to 2,790 million for distribution expansion and improvements.

Total system losses in PESCO during FY2009-10 were 37.1% as reported by NEPRA. A review of the data provided to the team on 11kV feeders indicates that distribution loss was 32.6%, leaving 4.5% 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 4.5%, including loss in grid substation transformers. This confirms the value measured by PESCO and indicates that metering for the transmission system is adequate. Transmission losses of 4.5% are high, but the cause appears to the extensive 66kV network, which, although carrying less than 20% of PESCO's total demand contributes almost 50% to its transmission loss. There was no compelling evidence that transmission issues contribute negatively to the financial performance of PESCO and it was decided early in the assessment to focus effort on distribution issues, which were clearly more demanding.

2.2.4 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, Planning and Engineering - 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 PESCO cannot be described as adequate. The Head of the Planning & Engineering Department was recently appointed from Grid Station Operations (GSO) after securing his promotion and will superannuate in the coming months, meaning that he is in a transition period prior to retirement. Distribution planning has traditionally been carried out in response to identified problems, but more efforts are underway for system expansion especially on LT networks under funds allocated to legislators for their areas. In FY 2009-10 only 18 work orders were issued for HT rehabilitation/bifurcation under the ELR program whereas 600 job orders were issued for LT network, including augmentation of distribution transformers or addition of new LT networks.

Load Forecasting

A five year load forecast is routinely prepared, however decisions regarding growth rates employed per customer class are determined by NTDC and communicated to the DISCO. No overt efforts at collection of

load forecasting data, such as population growth, demographics or historical sales data is carried out by PESCO. Data on sales by consumer class is supplied to NTDC, but the process is prescriptive once the growth factors have been received; that is the PESCO staff projects demand and energy requirements at the established growth rates, and then subdivides the resulting load among the various grid substations. Nothing further is done with the forecasts. NTDC also prepares a Power Market Survey report by compiling Grid/Substation daily peak load data and based on historical growth this determines the Growth Factor to be used by DISCOs for planning new Grid Stations.

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 in PESCO. When feeder loading approaches a pre-determined maximum value, 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. The Planning 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 program. It operates in MS-DOS and is capable of analysis of a single feeder and its branches, producing a tabular output that assesses voltage drop and calculates losses both for demand and energy. The software can model capacitors and also functions as a work order generation tool, with a database that can produce a material list for new construction. Produced as it was by USAID, the software has no cost to the utility and any number of users can be accommodated. This can be a problem in that multiple persons may have different versions of the same feeder model, leading to confusion during analysis.

While certainly advanced for its time, the software is currently outdated and lacking in many of the features found in contemporary distribution analysis software; such as direct input of GIS mapping data, optimization of capacitor placement, analysis of looped systems, modeling of multiple feeders and graphical presentation of results. The software 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, somewhat inhibiting the incentive to do alternative evaluations. The limitations of the software make it difficult to do multi-feeder area planning and exploration of system alternatives, which could result in sound distribution expansion, operation and maintenance. Also, though this program has the capability to determine distribution transformer losses connected on the feeder, it is not being utilized as the users do not have the transformer specifications available and are not aware of the concepts of transformation losses. In a number of cases, especially for urban distribution feeders, transformer losses are almost equal to the conductor losses. Mostly, focus is made on re-conductoring or bifurcation of the feeders.

The transmission department of PESCO, in common with that of other DISCOS, has a license for PSS/E, the software produced by Power Technologies Incorporated and widely used in the US for transmission system analysis. Some consideration was given to using PSS/E for distribution planning, but this was abandoned due to the complexity of the software and lack of resources to renew software licenses. What is

needed is an intermediate solution that addresses the shortcomings of FDRANA while still being simple to use and low in cost.

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 PESCO, 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 towards 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 PESCO'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 hampers the usefulness of the Osprey conductor.

Though the PESCO system is only congested in urban areas, such as the old city of Peshawar, the national design standards adequately address the challenges faced outside those areas, and the Chief Engineer Planning did not consider it a high priority to seek changes to the standards. One area which PESCO has not pursued and which could have an effect on their operations is the use of multiplex or aerial bunched Conductor (ABC) LT line; however, it could be of use to reduce the possibility of unauthorized hooking or "kunda connections".

Construction

The mission of the Project Department at PESCO is, as stated by the Project Director Construction, that of execution. He emphasized that the Project Department does not do any design nor procurement but that it is responsible for construction of all distribution facilities in the PESCO as well the TESCO service areas. However, proposals are prepared for village electrifications after performing physical survey of the area sponsored under MNA & MPA funds. The projects undertaken by the Project Department fall into three categories

- Projects funded from PESCO's budget for distribution upgrading and energy loss reduction.
- Village Electrification Projects funded by MNA's & MPA's funds.
- Deposit work paid for by others, such as line relocation required by road widening and village electrification.

Village electrification, which amounts to approximately 55.5% of PESCO's construction activity, is considered deposit work due to the way in which it is carried out. There is no village electrification master plan, so the annual budget does not contain any expenditure for this purpose. Rather, a member of the national assembly identifies an area that he/she wants to be electrified, and obtains the funding from the national or local government for the project. According to the rules governing these types of projects, PESCO can include in the budget for a village electrification project only those amounts that are required to construct the necessary 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/Provincial Assembly, depending on their influence or relationship with the governing party, have allocations they can use to demand construction of projects.

For village electrification, the Project Department examines the locale of the project and prepares its own proposal and material list for drawing on stores. In many cases, according to staff, the total material requirements for a particular project are not available in stores, sometimes missing only a single class of item (bolts, or D-irons for example) which then requires a delay in construction.

The Project Department constructs all projects with its own work force, with the exception of the setting of concrete poles which is contracted out. The Division is self inspecting, i.e. there are no construction inspectors as such. 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 PESCO system by the PDIP engineering team indicated that the work was found to be adequate but generally inconsistent and not as per Standard Construction Drawings issued by the office of the CE Design & Standards. Poles were sometimes not properly plumb, transformer platforms were not level, and sags of conductors were not even. 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 that it was also difficult to keep linemen in the construction division. As soon as they attained their certifications as linemen, they would try to transfer to the Operations Divisions where the work is less strenuous. The Project Director cited instances in which political influence, even extending up to the Ministry's level, was used to pressure the reassignment of linemen from the construction division to operations.

Operations and Maintenance

The fundamental organizational unit for operations at PESCO is the subdivision, of which there are 143 in the company, each serving approximately 18,000 consumers. Operations subdivisions are defined geographically by feeder service areas and are grouped into divisions with approximately four to five subdivisions per division for a total of 31 operations divisions. Divisions are grouped into circles with approximately five to six divisions per circle. PESCO has a total of six operations circles. In addition to the operations division and subdivisions there are other divisions and subdivisions for meters and testing as well as for construction.

Peshawar Circle was visited to understand how the area under this jurisdiction is managed. This particular circle serves 439,368 customers through 6 divisions and 29 subdivisions with 8,849 distribution transformers of various capacities, 3,440 km of HT and 4,064 km of LT lines. Last year the progressive losses were 32% whereas this year it has improved to 30%, which is still very high for a predominantly urban circle. This high loss figure was attributed to old and, worn out energy meters, lengthy LT lines, and service drops especially in the congested areas of the Peshawar city with exposed LT tempting illegal tapping i.e. "kunda' connections. The Superintending Engineer also expressed his concerns over the quality of electronic meters especially the time of use (TOU) meters. He stated that often the display goes off because of poor quality batteries used within the meter which cannot be replaced by the local M&T staff.

The principle activities of subdivision staff are as follows:

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

Each subdivision typically has approximately 70 staff, of whom roughly 60% are assistant linemen, linemen, or line supervisors; 15% are meter readers and bill delivery staff; 5-10% are complaint center staff; and the remainder are managers or other support staff. It was stated that only about half of the linemen could be depended upon to carry out climbing duties due to age, infirmity 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. However, in certain cases minor complaints of burnt LT jumpers are locally attended to by non utility staff especially in remote areas. The complaint register was examined and most complaints found to be of high and low voltage jumpers, or of loose/excessively sagging bare conductors posing a threat to the general public.

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 are not 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 adequate for use on high voltage lines. All of the switch sticks and ladders were stored in ways and places that exposed them to damage from other items lying against them. The picture below shows a typical locally customized switch stick being used in the field:

The tree trimming hooks were dull and unlikely to be of any use whatsoever. The subdivision building was very cramped and in poor condition, and the stores area full mainly of debris such as broken insulators, recovered wire and hardware, etc. No doubt some of these items were to be reused to restore service, but there was little new material to be seen.

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

The installation and the health of 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 picture below shows a number of meters housed in a steel box with open terminal covers that cannot be considered secure, or even safe for the general public in spite of the fact that these are in service. The PDIP team failed to understand as to how these meters are being read without any reference number or even visible register.

Similarly, the installations of distribution transformers were witnessed to be hazardous as shown in the picture below:

The Subdivision had one or two light vehicles for general transportation, of which one vehicle is reserved for the use of the Sub Divisional Officer (SDO) and the second dedicated for maintenance use. PESCO employees reported that the complaint center lineman and the meter readers use their own motorcycles to transport themselves, or walk. 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 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 loads are not recorded for all the transformers in the subdivision on a regular basis. In practice subdivision normally do not maintain load ledgers, and review and record transformer load levels when transformers are suspected of overloading. This is clearly inadequate and contributes to the poor transformer reliability.

The engineering team observed that issues affecting lineman safety in electric utilities are not unique to PESCO 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 PESCO 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 is an issue in PESCO as WAPDA standards are not 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 by PESCO staff but needs further examination.
- Poor work planning procedures that do not consider safety as a goal of the project.
- Failure to maintain an environment in which safety is emphasized on a daily basis as part of the work schedule.
- Lack of sanctions for staff that knowingly violates safety procedures and by its example encourages others to do so.

Most of these issues are within the control of management, and the engineering team finds it disingenuous at best to blame deceased linemen for their own fatalities.

Meter Security

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

PESCO's generally high level of losses indicates that these vulnerabilities are among the major issues and observation indicated that most meters were poorly installed. Bottom connections on the meters were not covered or sealed however, and PESCO does not have a meter testing program, so older meters are likely to be slow or even dead. The inspection of the meter fleet indicates that meters are generally not secure and still constitute vulnerability for PESCO.

Procurement

Procurement is carried out by the Procurement Department. The Department prepares a procurement budget based upon the material issues during the last 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 into 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 requested 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, Asian Development Bank, etc.) follow different procedures and are handled by the respective project management units.

The Procurement Department at PESCO is responsible for management of the four central warehouses at Nowshera, Peshawar, Bannu and Abbotabad 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 the field stores associated with the operations circles. Once materials are transferred to a field store, 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 field store. This year the annual procurement was increased to Rs. 2.00 billion because PESCO territory was badly hit by the floods.

2.2.4 Distribution Feeder Mapping and Loss Segregation Analysis

As discussed in the Methodology section, the segregation of technical and non- technical losses for the PESCO 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 these 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 reported to PEPCO covering the fiscal year 2009-2010, PESCO operates 673 11kV feeders, totaling 31,285km of line. Average feeder length is approximately 46km. 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 PESCO 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.

- Bulk supply industrial and dedicated feeders/consumptions were not considered.

Data was obtained from PESCO on the entire feeder database. Because PESCO's customer information system links customers to the feeder that serves them, it is possible to obtain data on sales by feeder and this was also requested. PESCO 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:

- PESCO provided data on a total of 763 against 673 feeders communicated earlier in October 2010, however 54 of these had sales of zero for FY2010. This means that there are a total 709 active feeders.
- The consumption data does not correspond to the feeder input and thus we could not calculate losses with the information provided.

The anomalies in the data appear to be due to a slow process for updating feeder information.

After excluding feeders with anomalous or missing data, a selection was made keeping in view the area restrictions and security issues, and a random number system was used and tested against the criteria. A total of four feeders emanating from four 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 Characteristics of sales for feeders included in survey.

Feeder Name	Length	Demand	Sales MWH				
	km	Amps	Domestic	Commercial	Industrial	Agricultural	Other
Faqirabad	11.7	474	17,227	2,459	571	928	111
Charsadda_2	51.7	319	8,084	1,268	367	27	0
Chamkani	13.1	268	7,813	843	119	91	0
Baghbanan	63.8	422	17,539	1,779	296	444	0
Sample Average	35.1		84.5%	10.6%	2.3%	2.5%	0.2%
PESCO Average	**46.9**		**59.5%**	**7.7%**	**21.1%**	**4.5%**	**0.38%**

The table shows the sales breakdown for the sample of feeders chosen for mapping. The length of the feeders chosen for mapping averages 35.1km, compared with an average length of 46.9km for the system as a whole. The sales breakdown between consumer types for the sample urban feeders is not very close to that of the system due to the reason that PDIP's team was restricted to Peshawar and Charsadda cities because of security constraints.

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. 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 PESCO 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, PESCO 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 archaic PESCO transformer values of no-load and load losses, as shown in the Appendix.

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

Table 2.4 Results of loss analysis by feeder.

Feeder Name	Length km	Peak Demand kW	Line Loss kW	Transformer Loss	
				No-Load kW	Load Loss kW
Faqirabad	11.65	7,225	502.2	30.0	145.8
Charsadda_2	51.74	4,862	755.0	26.6	96.2
Chamkani	13.13	4,802	262.7	18.7	77.1
Baghbanan	63.78	6,432	752.1	37.8	108.1

While these results assess the line and transformer losses of the feeders, it is necessary to evaluate the losses of the LT networks and the service drops to obtain a complete picture. Because the number of LT networks on any of the feeders is substantial, it was necessary to carry out a sample survey. A total of five LT networks was mapped and modeled. The process of mapping differed from that used for the 11kV feeders in that for the LT networks, the mapping included a consumer census of all the consumers fed by the network. In addition, a meter reader accompanied the survey team, carrying with him the meter read route book from June 2010, the month of assumed peak demand. It was therefore possible to obtain and record in the GIS database for the LT network the metered consumption for each consumer.

Since the majority of the consumers located on the LT networks are billed by kWh consumption only, it was necessary to convert the kWh data to demand (kW) for modeling. As no measurements of actual demand were available, it was necessary to estimate demand using only the average energy consumption of the consumers. In order to determine the peak demand in kW likely from consumers on each LT network during

the month of June, the data on consumption was applied to the demand equation below. This equation was derived many years ago by the Rural Electrification Administration (REA) in the United States, and has been verified by NRECA as acceptably accurate for use in developing countries as well. The equation is as follows:

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

Where:

D= Monthly peak demand in kW for a particular group of consumers
N= Number of consumers in the group
C= Average monthly consumption per consumer in kWh/mo.

The demand value calculated by the equation was applied as the source demand for the particular LT network, at the power factor resulting from the HT model, and the demand allocated to the segments of the LT network in proportion to the kWh of the consumers connected to that segment. The result is shown in Table 2.5 below:

Table 2.5. LT loss summary.

Feeder Name	U/R	LT Length (km)	Transformer Size kVA	LT Source Load kW	Source p.f. (%)	Total Losses kW	%	W/kVA
Shahi_Bagh_Faqirabad	U	0.22	100	82	84.6	0.89	1%	8.9
		0.35	200	158	84.6	5.63	4%	28.15
Peshawar_City_Chamkani	U	0.28	100	49	82.1	0.93	2%	9.3
		0.84	200	76	82.1	0.8	1%	4
						Average Urban	2%	22,6
Charsadda_Charsadda_2	R	1.77	200	61	85.1	2.87	5%	14.35
						Average Rural	5%	14.35
						Average All LT	3%	26.1

The results of the LT analysis show that LT losses vary from 1% to 5% of the power delivered by the transformer. Average loss for the LT network is 3%. The lengths of both urban and rural LT networks were in the order of 700 meters per transformer, although one of those sampled was only 220 meters. Loading for this group of transformers varied from loads of no more than 30.5% of capacity to 82% of capacity. Of the transformers chosen, none was overloaded in June 2010. It is clear that relatively few of PESCO'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 26.1 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 residence. This had the effect of shortening the effective length of the service drop from the utility's standpoint, to something less than 10 meters. Examination of the system indicates that this process has not been completed in many urban areas, and the meters are still located on the exterior of the buildings. For this reason, the average service drop length has been assumed to be 12 meters. Table 2.6 below indicates the assumptions for the three types of consumer.

Table 2.6 Consumer service drop characteristics.

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 PESCO 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 PESCO 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. Summary of loss analysis.

Feeder Type	Conductor Loss %	Transformer Loss %	LT Network Loss %	Service Drop Loss %	Annual Energy Loss %
Total Sample	**8.8%**	**2.1%**	**2.3%**	**0.2%**	**13.4%**

It should be noted that, due to the disparity between the average length of the sampled feeders and system average, conductor loss was corrected to reflect the loss of a feeder of system average length.

Because the sample was chosen to be representative of PESCO as a whole, the interpretation of this result is that the technical losses of the utility's distribution system are in the range of 13.3%. As noted above, PESCO had actual distribution system losses of 32% in the 2009-10 fiscal year. The difference between the distribution technical loss of 13.3% and the total distribution loss of 32% is a non-technical loss of 18.7%. This is a very high proportion of non-technical loss.

Validation

PESCO, in its report to the Ministry of Water and Power of October 2010, reported technical losses of 15% and non technical losses of 19.1%. This is slightly at variance with the results presented here, but and it was decided to carry out an independent evaluation using a benchmarking technique developed for electric systems in the rural US. Studies conducted by the Rural Utilities Service, the financing and monitoring arm of the US rural electric program, have determined that for systems using conductors and voltages typical of good engineering practice, distribution system loss is a complex function mainly of sales density, that is MWH sales per km of line. The equation developed based upon that parameter is as follows:

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

Where:

L= Total losses (technical and non-technical) in percent
H7= Sales density in MWH of sales of all types per km of distribution line
LN= Natural logarithm function

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

Applying this equation to PESCO, results are in the following table 2.8:

TABLE 2.8 PESCO BENCHMARKED LOSSES

HT & LT Km	Sales Density MWh/Km	Benchmark Technical Loss %	Actual Distribution Loss %
76,905	84.6	7.9%	34.1%

It is apparent that according to this benchmark, PESCO should have a distribution loss of approximately 7.9%. This does not agree well with the 13.4% loss determined through the modeling exercise, and indicates that both technical and non-technical losses are unacceptably high in PESCO. High technical losses are due to heavily loaded distribution circuits and the high ratio of LT to HT line. The high non-technical losses of 20.7% are likely due to poor commercial practices and a high degree of theft.

Possible Technical Opportunities for Reduction of Non-technical Loss

The high technical and non-technical losses experienced in PESCO demand concrete efforts to achieve acceptable loss levels. Potential opportunities are as follows:

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

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

- The ratio of HT to LT line length needs to be improved by extending more HT laterals and intersetting small transformers to break up the long LT circuits.

- Selective re-conductoring of heavily loaded feeders, particularly the first 10% of feeder length where a disproportionate amount of loss occurs would reduce HT losses.

- The engineering team was advised that approximately 95% of PESCO 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 than PESCO wishes to undertake at the present time, a campaign for testing 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 of connectors 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 MANAGEMENT

2.3.1 Overview

The financial management operational audit was designed to evaluate the effectiveness and efficiency of financial management for PESCO. The audit process has been designed to evaluate operational control against standards set by management. Factors included in the audit 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 PESCO's financial management:

Cash Receipts and Disbursements:

- PESCO's collection rate for government clients is much lower than it is for private clients; the collection rate for government clients is 53.8%, while for its private clients it is 84.2%. GOP accounting regulations prohibit making provision for past due receivables from government clients and therefore PESCO must consider all government receivables as collectible.

- PESCO 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 company's distribution margin. These taxes represent a significant financial burden.

- PESCO's balance sheet shows an amount of Rs. 22,511,896,499 at FYE 2010 receivable from TESCO on account of wheeling charges on the transportation of electricity through the PESCO network. TESCO has not been able to pay this amount to PESCO due to its own financial constraints.

Financing and Investments:

- PESCO, though it has revenues of Rs. 67 billion ($US 788 million) per year, invested approximately $31 million for system improvements and expansion in 2009-10. This level of investment is insufficient to maintain the 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 that will be required to perform internal auditing procedures as the organization has evolved and new system processes introduced.

- There is concern with the lack of training and professional competence within the Internal Audit Department.

Cost Containment:

- PESCO's vehicle fleet consists of a total of 722 vehicles, 270 of which are 20 years old or older. The company's fleet management policy requires vehicle replacement when a vehicle reaches ten years of age, but vehicles are rarely replaced on schedule due to conflicting approval policies. Even if PESCO were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy allowing for replacement of a vehicle. Not surprisingly, older vehicle maintenance costs are significant.

- PESCO has significant financial vulnerability due to a lack of insurance on its facilities. Grid stations and certain new vehicles are presently the only facilities covered by insurance.

Financial Reporting:

- The accounting system is unable to meet the growing needs of PESCO. The utility employs geographically disperse cost/revenue centers. The number and type of financial transactions are complex and diverse, and the data required managing these transactions quite voluminous. Additionally, the numerous PESCO officers involved in these transactions require a much more robust information management system to perform their duties well.

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

Financial Performance:

- The current ratio is an indication of an entity's ability to pay its current debts at present. Generally, a ratio below 1.01 means an entity may have trouble paying its current debt obligations. PESCO's current ratio of 0.63 requires monitoring should its financial position worsen.

- Maintenance expense as a percentage of operating revenue indicates that PESCO is spending significantly less than US rural electric cooperatives to maintain its electric system, 1.14% for the former compared to 7.98% for the latter. However, this is somewhat explained by the fact that PESCO has invested a significantly smaller amount in total utility plant per kilometer of line than the US cooperatives.

- The plant revenue ratio (total utility plant/operating revenue less cost of power) indicates PESCO has no operating revenue remaining after power costs to support its existing plant through operations and maintenance expense 6.7%, 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 PESCO's Rs. 500,852.

- The amount of trade debt receivables over 60 days as a percentage of operating revenue is somewhat higher for PESCO 1% ; than for the US cooperatives 0.23%. This comparison is based upon FY 2010 PESCO trade debt.

- The US rural electric cooperatives' consumer density averages 8 consumers per kilometer, while PESCO has 34 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while PESCO's consumer to employee ratio is 141 to 1. Even though PESCO slightly below average in consumers per employee when compared to other DISCOs (see Table 10 below), it could improve its financial position significantly by improving its consumer to employee ratio. Were PESCO able to achieve a consumer to employee ratio close to 467:1, the savings would approach Rs. 2.5 billion per year.

2.3.3 Analysis & Discussion

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

Cash Receipts and Disbursements

PESCO receives cash from various pay points including banks, post offices and NADRA with methods of payment including cash and online banking. All payment collection centers are required to transfer funds collected (net of collection fees) to the respective PESCO central bank account. The company receives 64% of its deposits the same day in its bank account; 22% of deposits, primarily from offline banking, are received within two to three days after payments have been made. The remaining 14% of deposits, received from post offices, take up to a week to be transferred to the PESCO primary bank account. The utility then makes daily payments from central bank accounts to PEPCO/CPPA without deducting any distribution margin and subsequent requests are made for the remittance of funds to cater for operational expenses at PESCO. While improvements can be made to improve cash transfers, a significant portion of payment receipts are transferred to the PESCO account on a timely basis.

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.

PESCO annual reports show significant trade debt receivables. It makes provision for doubtful trade debt accounts using the policy as shown in Table 2.9:

Table 2.9: Trade debt provisions for delinquent consumers

No.	Category	Value (%)
1.	Disconnected private consumers 1 year to 3 years	30%
2.	Disconnected private consumers over 3 years	50%
3.	Defective Shabqadar Area	100%
4.	Consumer receivables 6 to 12 months overdue	10%
5.	Consumer receivables 1 to 3 years overdue	15%
6.	Consumer receivables over 3 years overdue	20%

In fiscal years 2009 and 2010, a provision was recorded as an expense in the amounts of Rs 1,360,657,068 and Rs 1,691,825,999 respectively. In fiscal years 2009 and 2010, the trade debts that were written off were Rs 9,537,773 and Rs 2,121,631 respectively. Provincial and federal trade debts are required to have no provision related to electricity sales. Provision expense is included as an operations expense for purposes of Distribution Margin (DM) and the size of the provision expense may have an impact on the amount of DM received. In an analysis of FY 2010 trade debt receivables over 60 days as a % of operating revenue, PESCO was somewhat higher at 1.01% as compared to US rural electric cooperatives at 0.23%.

Following the assumptions shown in Table 3.1, PESCO accumulates provisions for past due accounts receivables under the observation that these accounts are uncollectable. The cumulative total provisions at PESCO amount to Rs 11,605,514,084. Given that it considers these accounts uncollectable, PESCO makes no further attempt to collect them. Alternatively, PESCO could consider engaging a collection agency to make further attempts for collection against these accounts, paying a percentage of the collected total towards achieving the collection targets on a contingency basis.

PESCO's balance sheet shows an amount of Rs. 22,511,896,499 at FYE 2010 receivable from TESCO on account of wheeling charges on the transportation of electricity through the PESCO network. TESCO has not been able to pay this amount to PESCO due to its own financial constraints. GOP has arranged funding through the Power Holding Company for TESCO to clear its liabilities. Efforts should be made to seek amounts due from TESCO through MWP. The external auditors have given a qualified report for the financial year ended June 30, 2010 and one of their concerns has been reproduced as follows:

"During the year under review the company has not recognized the liability in respect of electricity sold by CPPA to the Tribal Area Electric Supply Company Limited (TESCO) amounting to Rs 16,609 million. The overall liability in these respects, not recognized by the company as on June 30, 2010, is Rs 90,672 million. Management is of the view that TESCO is an independent company for the purpose of electricity purchase from CPPA and is responsible for its liabilities, and as such no liability is recognized in the books of accounts of the company. However, as evident from the direct confirmation received from CPPA the said amount has been charged to PESCO. Moreover, CPPA does not recognize any such transactions independently undertaken with TESCO. The authenticity and validity of the company claim in respect of TESCO's liability to CPPA remained unverified." This matter is required to be addressed by the Ministry and NEPRA for early resolution.

Additionally, PESCO receivables from KP government accounts equal Rs 1.4 billion in FYE 2010. Amounts have accumulated since February 24, 2007 due to less payments on account of tariff differential i.e. tariff notified by GOP and being paid by the AJK govt. The tariff rates for the AJK government are required to be determined by the Standing Sub Committee constituted for tariff determination and there is a gap between the NEPRA determined tariff and the one determined by the Sub Committee. The PESCO collection rate for government clients – 53.8%, is better than it is for private clients – 84.2%.

PESCO has not been able to raise the consumer end tariff for the last two years due to a legal petition filed by the Govt. of KP with the High Court. The KP High Court has stayed the increase in the consumer end tariff. This has had material adverse effects on PESCO's financial position for the years ended June 30, 2010 & 2009 and cost of power which exceeds operating revenue.

PESCO and the other DISCOs are required to retain, and later pay, taxes and license fees to local and federal agencies as a function of commercializing electric power. Some of 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 GST on all billings, regardless of whether the bills are actually collected. Thus, even though taxes are considered a pass-through, the difference between billed and collected taxes is paid from the DISCO's distribution margin. These taxes represent a significant burden for those utilities with low collection rates. The net general sales tax payable was Rs 1,357,919,154 in FY 2010.

The company owes CPPA against the Power Purchase Price of Rs. 126,240,203,849 and Rs 86,809,036,965 for FYE 2010 and FYE 2009, respectively. The main cause of this huge payable can be attributed to substantial amount of receivable from TESCO for Rs. 22.5 billion, receivable from Government of Pakistan against Subsidy for Rs. 29.6 billion, GST receivable of Rs. 6.5 billion and cap on the increase of consumer end tariff.

Financing and Investments

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

Local banks are not likely to be enthusiastic about extending long-term credit to the DISCOS, since as government entities they are subject to political requirements that are not always aligned with the DISCO's individual financial sustainability. PESCO's balance sheet does not allow arranging funding on commercial terms from the local Financial Institutions.

Generally, cash flow generated by operations is satisfactory only for meeting short term needs, making PESCO 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. PESCO, though it has revenues of Rs 67 billion ($US 804 million) per year, could only reliably undertake about $51 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 project 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. PESCO's rate of return on rate base may range from 13%-17%.

Internal Control

The team visited the regional warehouse at Nowshera and reviewed policies, procedures and operations. The PESCO 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 two regional warehouses and 13 field warehouses. The company's annual financial audit included observations with regards to the store shortages receivable from employees for Rs. 13,565,296 in FYE 2010. The store shortage investigations are performed based on the WAPDA manual of General Rules& Guidelines for Enforcing the Responsibility for Losses sustained by Authority through Fraud and Negligence of Individuals, 1982.

The Nowshera store has been damaged by the recent floods in KP province. The warehouse, originally built in 1935, remained submerged under 22 feet of water for about one month and this has adversely affected the integrity of the building as well as the efficiency of the people working there. A survey has been conducted to evaluate the store items due to heavy floods. The survey team has estimated these missing stores to be worth Rs. 5.3 million. 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 of PESCO. It establishes various approval authorities and monetary limits for financial transactions and certain other actions taken by PESCO management and the Board in the operations of day-to-day activities. The BFP was reviewed and discussed with the Finance Director as to the adequacy of the monetary limits. PESCO has prepared a draft of proposed changes to the BFP to address more efficient approval authorities and adjust monetary limits to reflect the current financial environment. These proposed changes were made with regard to maintaining high corporate governance and internal control standards. This proposal is pending for approval by PEPCO.

In a review of the Internal Audit (IA) function, it was determined the IA operations employ approximately 137 people out of a total of 152 sanctioned positions. IA continues to employ the WAPDA Audit Manual dated August 1985. In addition to the WAPDA Manual, IA uses a Revenue Audit Manual issued by WAPDA in June 1998 to replace Chapter 1 and Chapter 6 of the Audit Manual. The Revenue Audit Manual was designed to assist in the review and certification of consumer electricity billings and to report to Management about the status of compliance of policies and procedures regarding commercial operations. The functions of the IA Division, as defined in the Audit Manual under section 2.1 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". However, IA only functions as a financial control in the review and certification of consumer electricity billings. The external auditor is unable to rely on the work of IA due to IA's lack of independence and lack of competence. The existing audit manual does not address the specific audit procedures as the organization has evolved and new system processes have been introduced.

The Finance Director was highly concerned about the level of organizational employee competence and the lack of job descriptions with which to evaluate employee performance, negatively affecting the utility's performance of its designated role. Presently three important positions i.e. Manager CPC, Deputy Manager Tariff and Deputy Manager Banking are lying vacant.

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. DISCOs have historically been required to employ WAPDA facilities for software and other services that are not cost competitive with other private sector sources. The application of WAPDA requirements is not uniform across all DISCOs, so opportunities for savings may vary from one to the other.

In the case of PESCO, vehicle fleet maintenance costs were discussed with the Director of HR. The PESCO vehicle fleet consists of a total of 722 vehicles; 270 of these vehicles are 20 years old or older. The PESCO fleet management policy requires vehicle replacement when vehicles reach ten years of age, 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, vehicle maintenance costs are significant. Even though PESCO has a ten year replacement policy, this policy is not strictly followed. Even if PESCO were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy allowing for replacement of a vehicle.

PESCO is currently paying PEPCO approximately Rs 6,000,000 as a software license fee for three applications (billing, payroll and inventories). PESCO has significant financial vulnerability due to a lack of insurance on its facilities. Grid stations and certain new vehicles are the only facilities covered by insurance.

Financial Reporting

As described under Internal Control above, certain portions of PESCO's operations were adversely affected by the recent floods. The Nowshera store lost all prior year records. Presently they are holding store items valued at Rs 880 million. The external auditors of PESCO have given their qualified opinion on the state of affairs of the Nowshera store. Relevant extracts of their qualification are as follows: "We are unable to audit the accounts book of the Regional Store Nowshera (RDIC). It is the largest store of PESCO and most of its fixed assets materials are purchased via this store. Its account book remained unverified due to the heavy floods in this region resulting in damage of stocks and records."

Accounting functions continue to depend on manual processing. PESCO is presently using certain standalone software applications such as inventories, payroll and billing licensed by Power IT Company. The database generated by this standalone software requires manual entries to the general ledger.

The following is an extract from a section of the latest management letter addressed to the BOD by the external auditors: "The current accounting system cannot cater for the growing needs of PESCO, which comprises geographically scattered cost/revenue centers. The transaction and flow of data within these regions and to Head Office is complex in nature and huge in volume. Moreover the operations of PESCO have a significant customer touch points. The utility requires an integrated system with webs throughout its entity. "

PESCO is currently evaluating the implementation of an ERP solution. If implemented, the ERP would include financial, materials management and human resource modules. Benefits would include improved control at all levels; facilitation of day-to-day reporting; immediate access to enterprise-wide information; integration of basic business functions; and improved financial management and corporate governance.

All DISCOs are required to convert to the NEPRA Uniform System of Accounts by December 31, 2010. The new chart of accounts will be more detailed than PESCO's current chart. The company is on target to

meet the deadline and should provide additional management reporting detail. Like all other DISCOs, PESCO continues to use an archaic WAPDA accounting manual that has become increasingly outdated due to changes in accounting practices in Pakistan.

Financial Performance Indicators

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

For purposes of comparison, PDIP proposes to use financial and technical performance characteristics of the large group of rural electric utilities in the United States. These utilities are small in comparison to the Pakistan DISCOs; have far fewer consumers per kilometer of distribution line; but are characterized by low line losses, 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.

The current ratio is an indication of an entity's ability to pay its current debts now. Generally, a ratio below 1.0 means an entity may have trouble paying its current debt obligations. PESCO's current ratio of 0.63 needs periodic monitoring should its financial position worsen.

Maintenance expense as a percentage of operating revenue indicates that PESCO is spending significantly less than US rural electric cooperatives to maintain its electric system, 1.14% for PESCO compared to 7.98% for rural electric cooperatives. However, this is somewhat explained by the fact that PESCO 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 PESCO has no operating revenue remaining after power costs to support its existing plant through operations and maintenance expense when compared to rural electric cooperatives, (6.7) for PESCO and 6.3 for rural electric cooperatives. The rural electric cooperatives have invested significantly more in total plant per kilometer of line than PESCO, Rs 2,622,327 for rural electric cooperatives and Rs 500,852 for PESCO.

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.

The amount of trade debt receivables over 60 days as a percentage of operating revenue is significantly higher for PESCO than for US electric cooperatives: PESCOs trade debt to operating revenue ratio is 1.01%, while the US electric cooperative average is 0.23%. This comparison is based upon FY 2010 PESCO trade debt.

US electric cooperative consumer density averages 8 consumers per kilometer, while PESCO has 34 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while PESCO's consumer to employee ratio is 141 to 1. Even though PESCO is above average in consumers per employee when compared to other DISCOs (see Table 3.2 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 PESCO able to achieve a consumer to employee ratio close to the US average, the savings would approach RS 2.5 billion per year.

PESCO's negative equity and current year net income has resulted in a negative return on assets (10.4)%, equity as a % of total assets (37.3)%, and long term debt as a % of total capitalization (2.8)%.

Table 2.10: PESCO/US cooperative performance ratio comparison

Category/Performance Indicator	PESCO	US Cooperative Ave.
Liquidity		
Current Ratio	0.63	1.6
Amt over 60 days/Oper. Rev (%)	1.01	0.23
Profitability		
Return on assets %	(10.4)%	5.07%
Op Rev/km line (Rs)	911,768	1,528,519
Consumers/km line	34	8
Consumers/employee	141	467
Main exp/Op Rev (%)	1.14%	7.98%
Op Exp/Op Rev (%)	10.31%	7.03%
Cost of power/Op Rev (%)	107.5%	70.55%
Plant Utilization		
PRR (one year plant rev. ratio)	(6.7)	6.3
Total plant/km line	500,852	2,622,327
Solvency		
Equity/Assets (%0	(37.3)%	42.4%
Long term debt/Ttl. Capitalization (%)	(2.8)%	52.0%
Line loss (%)	37.1%	5.0%
Elec. sales collected/Elec. sales billed (%)	66.2%	N/A
Government	53.8%	N/A
Non-government	84.2%	N/A

2.4 COMMERCIAL MANAGEMENT

2.4.1 Overview

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

2.4.2 Summary of Key Findings

The following are key findings of the PDIP review of PESCO's commercial management:

- **New service connections—** The lack of meters delays the connection of new customers, leading them to bypass the application process. Several factors designed to minimize mistakes in the data entry into the customer information system unfortunately contribute to significant delays in consumer billing – sometimes for several billing cycles. As a result, some newly connected consumers have received service for more than a year before receiving their first bill. At the end of October, 29958 ripe (paid) connections were pending at PESCO, and 40% of the 5749 new connections remain unbilled for periods greater than 3 months.

- **Meter reading—**Numerous problems were found in the area of meter reading. Commercial management and employees indicate that there is insufficient time to perform the randomized evaluations of meter reading accuracy that are supposed to occur. Moreover, review of meter reader logs revealed that meter readers do not consistently identify and record problems with meters. Further, PESCO does not employ a practice to remove, clean and calibrate meters. The company has a program to eventually replace the electro-mechanical meters with electronic meters, but many meters remain electro-mechanical.

- **Bill preparation—**There are no computerized revenue offices, so the billing process involves manual data transfers and data entry, which often cause delays. One person at the computer center can enter 6,000 meter reads in a day. Bills are processed in batches that comingle customers from all divisions, so if one reader is behind schedule the bill preparation for all divisions is delayed.

- **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, meaning that delays in any part of the process will result in delays of delivery of bills to the revenue office where they are sorted and delivered to each subdivision. Delivery is by hand, so lack of transportation also routinely delays bill receipt and payment.

- **Bill adjustments—**Adjustments to consumer bills are usually made by the SDO, but the bill must be approved by the XEN and SE before it is returned to the consumer's revenue office for data entry. Since there may be a substantial time lag in processing the adjustment, the consumer may have to return for another adjustment. Some circles use adjustments in place a meter readings; units adjusted were nearly double the amount of readings per the reading lists.

- **Payments—**The payment handling arrangement is also fraught with inefficiencies and requires frequent, manual intervention. For pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. The revenue office reconciles stubs and scrolls; this usually takes three-four business days. The bank will not accept payment amounts less than the amount indicated on the printed bill. As of the end of October, the collection rate was 73.4%

- **Disconnection/reconnection—**Because of the ease of directly connecting to the system, PESCO frequently chooses not to disconnect defaulting customers. While the prescribed process for disconnecting/reconnecting delinquent customers is reasonable, it involves a number of separate departments and is not automated, introducing potential risks and delays. At the end of FY 2010, over 178,000 Equipment Removal Orders were outstanding for 60 days or more.

- **Customer service**—At the local levels, there are few dedicated customer service representatives. Personnel are assigned to man the windows for a few hours and then they return to their other duties; hence there is little or continuity in resolving customer issues. The current customer care system is practically nonexistent, creating client frustration. An efficient and effective customer care system is needed by PESCO and its counterpart DISCOs.

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

guidelines. Nearly 27,000 defective meters are still in service of which more than 2000 were declared defective more than three years ago.

- **Advanced meter reading—**PESCO does not use advanced meter reading technology. This suggests that the meter reader has discretion in reading and manipulating the meter readings. With the manual meter reading processes, losses can be controlled by adjusting readings.

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

- **Meter integrity and meter reading practices—**With the shortage of meters, PESCO is reluctant to declare any more meters as defective. Replacing defective meters is a performance indicator. A meter may be declared defective when it is actually working; the consumer is then billed on the average consumption of the last 11 months. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer. Since it takes months for the meter to be replaced, the air conditioning season is over before the consumer is billed on actual consumption again. Also, with many meters located 7-10 feet above ground, it is difficult to detect meter tampering.

- **Information technology**—Presently, PESCO business processes are characterized by manual and cumbersome practices, inadequate controls, insufficient commercial focus, limited transparency and lack of reliable information. The use of information technology to improve efficiency and effectiveness has not yet proven successful. Several standalone applications are not integrated either with other applications or with potential applications to be deployed in the future. Although the level of deployment of IT varies significantly from one DISCO to another, the key applications have been in multilevel aggregation of data or 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. PESCO's move to a computerized environment is an opportunity to rationalize and update core business processes as a prerequisite to further automation.

2.4.3 Analysis & Discussion

The revenue cycle in the DISCOs, including PESCO, is governed by three main documents;

1. Commercial Procedures, 6th edition-November 2000, plus amendments which have not been codified;
2. Consumer Eligibility Criteria, 2003; and
3. Consumer Service Manual, 2010.

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

In response to the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 (the Act), the National Electric Power Regulatory Authority (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. The Consumer Service 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; for completing service connections, meter reading, bill processing and delivery; and for resolving complaints are addressed in the Manual. The Manual also includes safety and conservation tips for the consumer. The frequent clause "(DISCO to insert its name)" implies that all DISCOs are to follow the policies stated and are not encouraged to develop their own Consumer Service Manual, but to use the standard NEPRA document.

Overview of Revenue Cycle

The PESCO (and other DISCO's) revenue cycle is composed of a number of interrelated steps. The first step, a pre-revenue prerequisite, is the application for service connection. There are non-recurring fees assessed in the application and connection process, so this is in fact a part of the revenue cycle process. Once a consumer has received a service connection and begins consuming electricity, the DISCO revenue system must collect consumption data, process the data, print and deliver the bill, and collect revenues from the consumer. Each step requires a structured set of actions that must be orchestrated to allow the DISCO to manage an extremely high volume of transactions on a monthly basis. The following sections of this report describe each step of the revenue cycle for PESCO; 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 premises are registered. Should the occupant of the premises change, the consumer identification number is not changed, merely the name associated with the number. Numbers are assigned in the walk order of the meter route. As new structures are added, the route must be renumbered to adjust to the additional structures and the consumer is assigned a new account number.

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

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 who are within 40 meters of the connection point are charged a flat fee. A demand note for the connection fee and another for the security deposit are prepared and sent to the consumer. The consumer has 30 days to pay the demand notes at the pay point specified. Once payment has been made and the subdivision office notified, the consumer is added to the queue for new connections. New connection efficiency is measured by the length of time from payment of the demand notes until the consumer is connected and billed.

A service connection order (SCO) is prepared after the fees are paid. The meter, cable and necessary materials are drawn from stores, and the connection is installed. Unfortunately, the materials needed are often not available for several weeks, in some cases years, after payment of the demand note. There is no communication between stores and the personnel preparing demand notes. Inventory has a computer system, but it is not integrated with any other system. The consumer will still pay his/her note in order to get on the priority list for installation. Management reports that there is pressure to expedite certain customers. When the consumer finally gets connected, the completed SCO is sent to the revenue office to enter the consumer into the billing system.

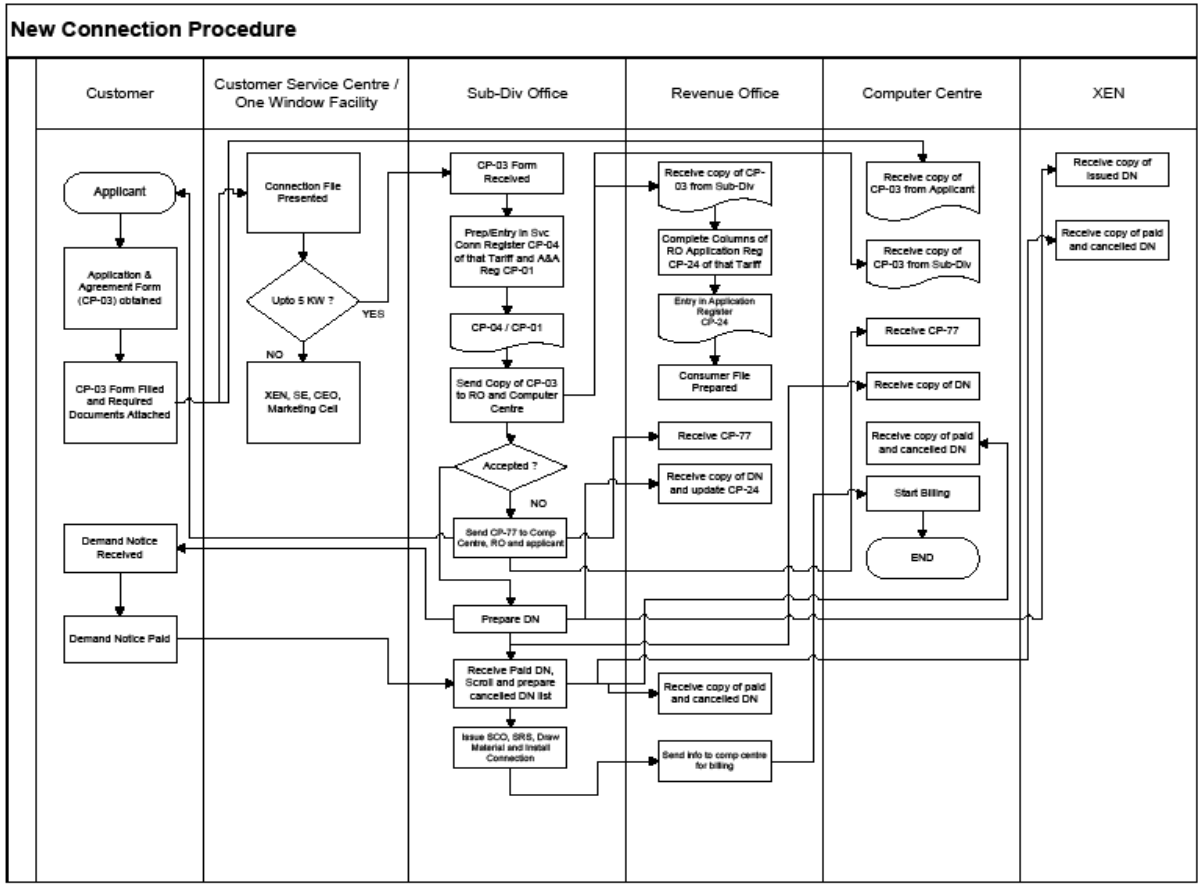
The target is to have new connections installed 35-45 days after the registration of the application. However, the target does not take into account the delay of payment by the consumer or the shortage of material in the warehouse. One list of connections installed showed that demand notices paid in 2007, 2008 and 2009 were

finally recorded as connected in November 2010. In some subdivisions, the consumer will directly connect to the system rather than apply for a new connection. Other areas have a shortage of application and agreement forms. At the end of October, 29958 ripe (paid) connections were pending at PESCO.

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

The delay in billing the consumer is the result of the process. SCOs and a transmittal form for new connections are sent once a month to the revenue office. The revenue office prepares an input sheet of new connection data. This information is sent in electronic format to the billing center. The billing center then prints a "pre-bill" listing so the revenue office can verify the data. If the data is not correct, the errors are corrected, sent back to the billing center, and a pre-bill list is printed again. Once the data is verified and accepted as correct, the first billing cycle may have passed. The PEPCO report for the FY ending of June 30, 2010 listed 5749 new customers had not received their first bill; nearly 40% of those customers had been connected for more than 3 months. 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 3.1 illustrates the new connection procedures.

Figure 3.1 Current New Connection Process



Meter Reading

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

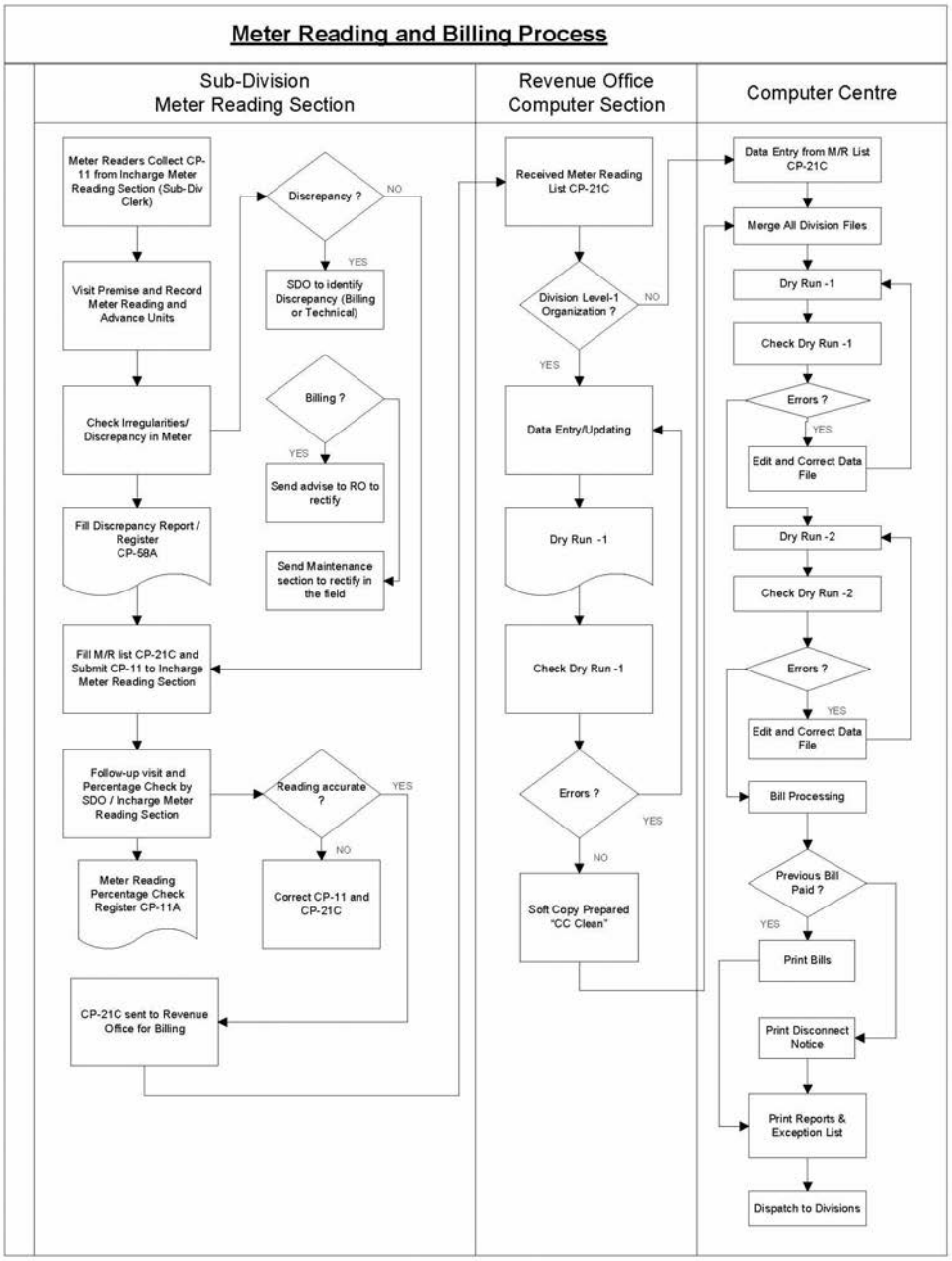
There are a variety of strategies that can be employed to address problems with meter reading, including auditing meter readings; rotation of meter reading employees; outsourcing meter reading services; use of advanced metering technology including automated meter reading and/or use of pre-paid meters.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

PESCO and its DISCO counterparts are required to employ checks and balances in their meter reading policies and procedures in an effort to ensure robust and trust-worthy metered data from PESCO consumers. Unfortunately, this is the area of commercial operations for which there is a high degree of distrust and anecdotal information regarding employee manipulation. It is important to note that the purpose of this report is neither to present evidence of fraudulent practices nor to make unsubstantiated claims; its objective is to identify problems that affect DISCO performance, and to propose solutions to the problems that are noted.

While these measures have been designed into the PESCO/DISCO system, interviews with PESCO commercial staff and record sampling indicate that in fact there is little or no evidence that these procedures are actually followed. PESCO commercial management and employees indicate that there is insufficient time to perform the randomized evaluations of meter reading accuracy; and review of meter reader event logs revealed that meter readers are not consistently identifying problems with meters.

Figure 3.2 below illustrates the meter reading, data processing, and billing processes as described by PESCO commercial staff. As the diagram shows, the meter readers are responsible for meter inspection: to note problems with the meter enclosure, signs of meter tampering, meter stoppage or other problems. The diagram also shows that the Sub-Division Officer is also responsible for performing random checks of meter reading values – to verify if there are issues with particular meter readers. Thus, there are formal checks in place to detect meter inaccuracy, as well as to detect meter reading fraud.

Figure 3.2 Meter reading and billing cycle (general consumers) process diagram



With regard to the meter reading cycle, PESCO divides meter reading into a series of batches. Given that there are 20-23 working days per month, it divides consumers into 20-25 batches for purposes of meter reading, bill printing and delivery. This allows for continuous bill processing. The benchmark is for the bill to be given to the customer 10 days after the meter reading.

PESCO uses 20 batches to manage the meter reading and billing cycle for general consumers. These batches are read by the regular meter readers. There are additional batches for industrial and tube wells 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. It has been stated that exceptions are made where feeders intersect; it is more convenient for the reader to read the meters on adjacent feeders when the meter readers are 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 is then divided by the number of readers to create the daily route size. Because the subdivisions range in size from 7,785 to 45,636 consumers, many meters may not be read every month.

The billing center has the aim of printing meter reading lists 7-10 days or more prior to the scheduled meter reading date. The lists are delivered to the division office and then distributed to the subdivision offices. Because the lists are prepared in so far advance of the actual reading date, new connections may go unread for multiple months. The lists may reach the meter readers 3-5 days after the reading date. However, the readers do not use the reading list while reading the meters. Readings are recorded and consumption is first calculated in a "Kalamzu book" and then transferred to the reading list at the end of the day. The reader has two or more years of historical data in his book.

As the readings are transferred to the reading list, the reader recalculates the consumption. Because the reading lists contain the consumption of a prior period, the reader and/or management can adjust the reading so that the consumptions are comparable. It was not uncommon for the current reading and consumption on the reading list to exceed the reading and consumption in the Kalamzu book.

The purpose of calculating the consumption is to prepare a check for the data entry of the readings. The reading and the consumption are entered into the computer; a warning is issued if the computer calculated consumption does not equal the consumption entered. 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. Readings may be delayed to increase consumption for the month.

Bill Preparation

The meter reading lists from each subdivision are passed to the division's revenue office. The transfer process usually requires another day or so. PESCO currently has no Level 1 revenue offices. Four divisions are preparing to become Level 1 offices to enable them to do the data entry at the revenue office. Until then, the revenue office will review the lists for completeness, sort these by batch, prepare a transmittal form and send them to the computer center for processing. All lists for a single batch must be received before the transfer, so if one reader is behind schedule the entire batch is delayed.

The computer center will prepare bills once all lists for the batch have been entered. If all batches with the same number have not been received from all divisions served by the center, bill processing will be delayed. If closing for the previous month has not been completed, bill processing will be delayed. The benchmark is to print bills 7-8 days after the meter reading date assuming there are no delays.

The issue date on the bill is not always the date when the bill is printed. The issue date is always the scheduled date even if the schedule has been delayed. However, the due date on the bill is calculated from the issue date—normally 14-17 days from the issue date.

The billing program that is being used by PESCO 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 SEQUEL. The database is designed

exclusively for electricity billing activity. However, the COBOL program will not allow PESCO to include other revenues and security deposits in the bill.

COBOL is designed for batch processing. This has greatly affected the procedures used by PESCO and the other DISCOs. Most transactions are posted when the meter readings are posted. The transactions may be entered as received, but they are not added to the consumer's account until the batch is processed. The batch is not processed until every division has submitted its data for that particular batch.

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

PESCO has five billing centers. Customer service centers are connected to the system so that duplicate bills can be produced. However, bill adjustments must go through the revenue offices.

PESCO monthly bills should be reformatted. The current format is difficult for the consumer to determine if adjustments for previous months have been posted to his/her account; how the arrears (past due balance) amount was determined, or the amount on which taxes are levied calculated. For transparency, the bill should begin with the previous month's balance, and then show all transactions for the current period, followed by the balance now due. Once the bill is prepared and ready for delivery, the batch should be closed and all adjustments to the consumer balance will appear on the next bill.

Bill Delivery

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

Usually, Revenue Office personnel are responsible for bill delivery but PESCO assigns bill delivery responsibility to the SDO. Bills are hand delivered to urban consumers. Because transportation is not provided and due to the shortage of delivery personnel, many bills are left at a central location, and the consumers are responsible for collecting them from pre-defined locations. This introduces another source of risk to the bill delivery process.

Bill Adjustments

Bills can be adjusted if required. Most adjustments are prepared at the subdivision or division offices. Frequently the consumer approaches the SDO who may recommend the bill's adjustment. The recommendation is then forwarded to the XEN for his approval. The XEN usually only approves the recommendation; the SE is the one who actually approves the adjustment in most cases. The approved adjustment is then sent to the RO for data entry.

Adjustments are not sent to the SE on a regular basis. Consequently, the consumer will walk his bill through the various offices to ensure the adjustment is approved and received by the RO who will then enter the adjusted amount on the bill. Occasionally the SDO will go ahead and adjust the bill; he may or may not fill out the required forms for further approval and data entry into the computer.

Adjustments to consumer bills can be made at the service center, but the information must be returned to the consumer's revenue office 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 the adjustment is actually entered into the computer. Adjustments are forward to the computer center with the next batch containing the consumer's meter reading. If there is a substantial time lag, the consumer may have to return to the billing center for another adjustment. In other words, the back office procedures do not follow through with actually adjusting the consumer records.

Some circles use adjustments in place a meter readings; units adjusted were nearly double the amount of readings per the reading lists.

Adjustments Against Domestic Consumers

Circle	Oct-10 Units Billed			Jul-Oct 2010 Units Billed		
	Net Units Billed	Units per MR List	Adj Units	Net Units Billed	Units per MR List	Adj Units
Peshawar	99.39	87.73	11.66	407.12	378.72	28.40
Khyber	65.48	65.81	-0.33	270.35	271.62	-1.27
Mardan	54.81	54.59	0.22	223.12	219.42	3.70
Hazara	48.06	48.54	-0.48	196.40	198.70	-2.30
Swat	46.70	41.90	4.80	156.50	150.53	5.97
Bannu	65.84	32.94	32.90	235.50	116.55	118.95
	380.28	331.51	48.77	1488.99	1335.54	153.45

source: Monthly Progress Report

Payments

Payments for power can be made at any commercial bank that has teller arrangements with PESCO, at local post offices, at NADRA kiosks, or occasionally made electronically. As payments are received, the pay points prepare a scroll documenting the customer account and the amount paid. If the banks have online facilities the customer information may be transferred electronically to the computer center. For those pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. This office reconciles stubs and scrolls; the period usually taking three-four business days.

The bank will not accept payment amounts less than the amount indicated on the printed bill. If the bill has been adjusted by the utility, the adjusted amount is hand-written on the bill. The payment stubs and scrolls are transferred to PESCO on a daily basis in most cases, but some divisions receive the scroll two days after payment. The money is transferred to the company's collection account. The timing of fund transfer is dependent upon the agreement between PESCO and the pay points.

Daily postings to the consumer accounts are balanced with the bank scrolls (receipt logs). Banks provide a weekly statement of amounts collected. The revenue office of each division is to reconcile the statements with the office copies of the bank scrolls. Not all divisions routinely reconcile cash postings and bank statements. Bank and posting errors may go undetected.

For the period July thru October, 2010 PESCO collected 11.8 billion Rs against the more than 16 billion Rs assessed. This was approximately 73% of the amounts billed.

The computer center is using an older format of the bill. This format is not bar-coded and the payment information is manually entered rather than scanned. Because of the manual process, reconciliations are imperative.

Disconnection/Reconnection

The consumer is notified of his payment default and pending disconnection with the first bill after the default. Approximately one week after the second due date, the billing/collection program automatically prepares a list of nonpaying consumers who are subject to disconnection through an Equipment Removal Order (ERO) for all who have not paid their outstanding balances within the grace period. The list is reviewed and edited by the billing supervisor and the revenue officer. The revenue officer has the authority to selectively delete consumers from the list, and those EROs are cancelled. The actual disconnection list is manually prepared because of the time lag between the computer preparation and adjustments for payments received.

The list and the equipment orders to be executed and the cancelled orders are sent to the revenue officer. These orders are sent to the technical department to be executed. On a periodic basis, the revenue officer is required to review the status of equipment orders to ensure that services have been disconnected.

When equipment orders are executed, PESCO technicians remove meters and services from the customer's premise, all of which are deposited and stored at the subdivision.

If the consumer pays all amounts due within one year, service and meter are re-installed. 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, the consumer may be reconnected, but is required to pay for a new service connection. He/she is then credited with the depreciated value of the equipment removed, but must also pay for a new meter. After three years, the consumer is required to pay the new current security deposit and the full equipment costs.

Because of the ease with which consumers can reconnect themselves to the system, PESCO executes few EROs. As of June 30, the PEPCO report stated that 178,000 EROs were outstanding for more than 60 days.

Customer Service

PESCO has a web site stating that there are service centers at each circle and at headquarters in addition to a mobile service center to process consumer complaints. The information on the customer service portion of the web site was out of date; incentive programs listed expired in 2006.

All DISCOs need an efficient and effective customer care system. Other utilities in Pakistan, particularly the telecom companies, have installed complaint ticketing systems where the customer sends an SMS under a short code to the complaint center, and the complaint system on receiving this will text back a ticket number for the complaint with a possible time for resolution and escalate the matter to a higher level, if not closed. This enables the utility to maintain a database of the complaints. Telecom operators have developed very efficient call centers for customer care. Partnership projects with different operators could be considered.

Many of the subdivisions visited stated that there were no service centers or numbers to call. Consumers walk in to the subdivision or division office to lodge their complaints. At the local levels, there are no dedicated customer service representatives. Personnel may be assigned to the complaint window for a few hours and then return to their other duties. Most complaints are handled directly by the SDO, XEN or RO. There is little or no record keeping of customer complaints or the actions taken. Therefore it is difficult to verify the number and type of complaints reported. Employee complaints of undisciplined consumers have lead to poor customer service.

The schedule of power curtailments in case of load shedding or maintenance purposes is either not publicized or if done is through the print media. This lack of information causes frustration and loss of time and money for the commercial sector. Telecom operators could be queried about offering an SMS broadcast solution, whereby each of the consumers who has provided his/her mobile number to the DISCOs will receive an SMS for such outage. Airlines have adopted similar systems with some success.

Commercial department organization

The Commercial function is partly managed by the Operations Director, the Customers Services Director and Manager MIS at the Headquarters level;, a Deputy Commercial Manager and Deputy Manager (MIS) at the Circle level; and a Revenue Officer at the Revenue Office attached to the Division. The Customer Services directorate is managed by Manager Commercial/Director Customer Services (CSD) who reports directly to the CEO; the Manager of MIS reports functionally to the Manager Customer Services and administratively to CEO.

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

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

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; and reconciliation of weekly bank statements with the cash book and of the debtors' control accounts. He also has responsibility for accounting matters under procedures laid down in the Divisional Accounts Manual.

- **General Section**: headed by the Commercial Superintendent responsible for receiving duplicate copies of certain specified application forms and other connection documents from the sub-divisional offices; and maintaining connection application registers and files for each consumer.

- **Billing Control Section**: responsible for controlling meter reading and data delivery to the computer center; ensuring that billing is correct; making adjustments to inaccurate or incorrect bills; issuing disconnection notices; preparing certain management reports/ statistics; and bill dispatch.

- **Debtors' Control Section**: responsible for controlling the computer prepared debtors' ledger, balancing ledgers, carrying out debt recovery action and preparing debtors' control reports and statistics.

Analysis of Changes in Revenue Cycle Practices

During the month of October 2010, Rs. 4.7 billion was billed. More revenue could be accrued with improved metering and meter readings. There would be an increase in cash collections if PESCO were able to enforce the disconnection policies. However, without the support of civil authorities disconnection of registered and unregistered consumers is not effective. Therefore equipment removal orders are outstanding for months. The utility prefers to keep the consumer connected and have some knowledge of his consumption rather than allow him to directly connect to the system.

Without sufficient materials, defective meters are not replaced. The material shortages also delay the new connection process. If there were a better mechanism matching new connections, there would be an increase in revenues 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. At the end of October, more than 40% of new customers had not been billed after being connected for over three months. Some had been connected for over a year without receiving a bill. In many cases, the consumer is billed after a period of delays, and the company makes concessions by allowing installments or even writing off portions of bills.

The revenue system could work more effectively if the practices and procedures were implemented with greater discipline. However, it is the undocumented transactions (aka administrative losses) that are worrisome. The calculation of technical losses and energy accounting would allow a better reconciliation of deliveries and amounts billed. Detailed analysis of this aspect of losses is given in the Engineering section of this report. Comparing losses of the current period to prior periods is not an accounting of energy. It just perpetuates the previous error.

Because there is much reliance on the meter reader in the revenue cycle, more rigorous controls and oversight are required of the meter reading cycle. It is impossible 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, the procedures are not adequately observed nor performed in a timely manner. The comparison of meter readings with the readings recorded in the Kalamzu book may provide some oversight. 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 reading upwards. Of the 669 11KV feeders controlled by PESCO, 99 had negative losses. The Bannu circle nearly doubles its revenue by issuing detection bills. 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, but is frequently ignored. However with the addition of automated meter reading the data is uploaded to the billing program, eliminating the need for manual data entry.

Meter lists and routes are not defined for individual feeders, which complicates energy accounting. 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 fluctuate with the changing seasons.

Meter routes should be organized around metered transformers and all of those meters should be read on the same day. The transformer number should be made a part of the customer record to calculate allocated load and total energy consumption at the transformer level. Meter reading of the transformer meter, if installed, can provide a sound base for energy accounting and transformer load management. 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 could be missed or recorded incorrectly, or there may be a problem with the system.

To prevent newly connected/reconnected cases going unbilled for several periods, logs of prepared service orders and status must be kept and monitored. Service orders should be in duplicate and copies sent to the revenue office, which should be responsible for follow-up when the order has not been cleared within a reasonable time. When a meter is reported as defective it should be replaced immediately. To help alleviate the shortages of meters, the utility should have its own meter repair and calibration lab. It would then be possible to fix it, recalibrate it and send it back to stores to be reused. If it is not economical to repair the meter, it should be dismantled for spare parts that may be used in future repairs.

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

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

Meter Maintenance

Random meter testing is not practiced in PESCO. Meters are only tested when there are consumer complaints, or when the meter reader notes a problem with the meter. At one subdivision, if a meter for a general consumer is removed it is destroyed rather than being refurbished/ recalibrated. Meters are tested if a consumer requests a test or the concerned 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. Moreover, 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 go unnoticed.

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

Meter replacement is frequently not done if the meter is reported as defective. A defective meter log is updated by the meter reader. The logs that were reviewed revealed that the entries are not numerous; defective meter logs may not be kept in some subdivisions. At some subdivisions that maintained a discrepancies register, only the discrepancy was recorded; no action taken was recorded. Due to the

shortage of meters, it may take several months to replace defective ones. As of the end of October, there were 26,487 single-phase and 481 three phase defective meters still in the field. More than two thousand of those meters were reported as defective over three years ago. Someone other than the meter reader should also inspect the meters on a regular basis.

Meter serial numbers are not routinely recorded when new meters are received from the manufacturer. Meters are "managed" at the sub-division level. When installed, their serial number is recorded in the Kalamzu book, and in the consumer's computer file.

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. AMR meters result in real time consumption data provided directly to the utility commercial system. Consumer usage can be monitored from a remote point of access (such as the commercial office).

Pre-payment meters may be used to allow consumers to purchase energy before using it. The basic principle of the prepayment system is that customers estimate how much energy they require before they consume it, and buy payment tokens (electronic or hard copy) beforehand from a vendor. The prepayment meter is then credited with the value of purchased credit. After the prepaid credit has been consumed, the meter automatically disconnects until additional credit is purchased and programmed into it. While there are advantages to the consumer (no more overbilling, control of 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, including improved collections and cash flow, and more demand-side management as the customer becomes aware of his consumption.

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 17,800 consumers. The largest subdivision had 45,636 consumers. Readers 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 PESCO and for the consumer.

PESCO declares that meters readers are being rotated. Some subdivisions rotate readers on a quarterly basis; others every six months. Rotations may be in form only, as readers may exchange reading lists once out of the office. Trade unions monopolize areas allowing employees to retain designated routes within specific subdivisions. This leads to a lack of objective meter reader control that in other countries has resulted in developing and sustaining personal income streams through fraudulent meter reading practices. In cases where meter readers are not rotated or constricted by trade union representatives, this has led to a lack of transparency, accountability and the required level of checks and balances needed for program integrity.

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

Theft Control

With a less than ideal meter reader rotation, opportunities for collusion with the consumers are numerous. Practices that can result from collusion include falsifying meter readings (recording low or high consumption as needed) and/or declaring meters defective to create estimated bills lower than actual consumption. Because the time required to replace defective meters is lengthy, invalid meter readings

could continue for some months. Collusion could also result in reporting lower consumption levels to ensure the consumer is billed at the lower slab rates.

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

Meter readings submitted for billing purposes are reportedly influenced by the management of the divisions and subdivisions in order to meet revenue and loss targets. Some consumers are overcharged to compensate for under billed consumers and losses due to theft. 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.

Many consumers are connected to the system without meters. The lack of available meters has delayed the connections to the point that many consumer no longer apply for connection. Because consumers frequently reconnect themselves after EROs have been executed, PESCO does not disconnect many defaulters.

Police and other civil authorities do not cooperate fully with the utility. PESCO has no administrative power to deal with direct hooks (theft) or defaulters (non-payers). One division filed 876 FIRs (First Incident Report) for the period July through November; only 53 were registered by authorities and none have been settled. Lack of security has made some areas of PESCO very dangerous and not conducive to utility operations.

One of the major tools for theft control is reconciliation of electricity consumption data from all points of termination i.e. grid, transformer and consumer. One method for bringing the metering verification closer to the consumer is to install master meters on the distribution transformers, and to compare the readings from these meters with those of the customers served by the transformers. Previous attempts to carry out this measurement have encountered difficulties due to differences in meter read times between the master and the consumer meters. The DISCO could streamline this process by installing AMR type meters at the transformer with continuous readings so that the transformer meter readings can be coordinated with the time at which the consumer meters are read.

Meter Integrity and Meter Reading Practices

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

With meters located 7-10 feet above the ground, it makes it nearly impossible 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 be difficult to state that someone has tampered with it.

Due to the flooding in the summer of 2010, several meters were either washed away or are no longer working. Those consumers without meters that have been reconnected are billed on an estimated basis. Although many meters have been declared defective, there is a reluctance to declare the totality since defective meter replacement is a performance target that cannot be met.

Customer Information System

Presently, PESCO's distribution system practices are characterized by manual and cumbersome processes, inadequate controls, insufficient commercial focus, limited transparency and lack of reliable information. As a result, commercial operations are highly inefficient with the potential for substantial revenue leakages and poor customer orientation. The use of information technology to improve efficiency and effectiveness is inadequate. Several standalone applications are limiting ability to effectively interface and

integrate either with other applications or with potential applications to be deployed in the future. Although the level of deployment of IT varies significantly from one DISCO to another, the key applications have been in multilevel aggregation of data or large-scale data processing. In other words, IT is being used as a tool to address a specific issue or two at a time and not as a long-term, holistic strategy.

The following are some examples of inefficiencies:

- A number of new connections are pending even after paying the capital cost and security amount because there is no material available in store. Availability of service materials is not confirmed prior to issuing the Demand Notice. An integrated materials management and work order module would allow PESCO to order materials when needed, and connect consumers on a timelier basis.
- PESCO does not have digital records of paid demand notices.
- Applications for new connections are managed manually (a number of hands and desks are involved), without any level of automation.
- Late submission of consumer consumption data to the computer center for billing new 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 tremendous vulnerabilities that can be relatively easily exploited.
- The customer services activities are not automated. One significant problem lies in the fact that the customer account records cannot be updated in real time, i.e. the customer's bill is revised manually but in many cases the same amount appears as arrears in next month's bill.
- Delayed billing due to non distributed billing/data processing system increases the bill processing and collection cycles, i.e. the computer center waits for data from all sub-divisions of all divisions of all circles before processing.
- Only one months' billing information is available on computer master file; historical data is off-line, i.e. in tape cartridges. Thus no trend analysis/drilling to discover the gray area of business could be performed.
- Delayed cash processing/posting (more than 10 days in some cases) delays the cash reconciliation process. Also, the management receives information very late.
- Delay by banks in remitting money to the company's account due to cash collection policy.
- Poor performance affecting collection from private customers resulting in accumulation of receivables amounting to RS. 27 Billion, as on 30th June, 2011, equivalent to 306 days of billing.
- No historical computerized record of service complaints.
- No computerized system for transmission loss calculation.
- Field staff is engaged in a number of duplicate activities, i.e. maintenance of documents/registers at many levels, copying information from one form/register to another form/register, etc.
- Unwillingness/non cooperation by non-IT users to use new technologies is a key hindrance towards improvement in customer/utility relationship.

2.5 HUMAN RESOURCE ASSESSMENT

2.5.1 Overview

Management and staff interviews held at PESCO have 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 well-defined responsibilities, where management is endowed with adequate authority and has accepted the concurrent responsibility that comes with this authority.

For all intents and purposes, PESCO continues to employ a close facsimile of WAPDA legacy HR policies and procedures. These do not reflect the values and attributes of a modern, independent and well-managed electric distribution company.

2.5.2 Summary of Key Findings

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

- The challenges facing the human resource infrastructure are serious and entrenched, because PESCO has been subject to both internal and external manipulation – by political sponsors, government agencies, trade unions and by employees themselves.
- It has yet to develop a strong and progressive corporate culture, in which management and staff have well-defined and clear responsibilities, where management is endowed with adequate authority, and all employees have accepted and understand their accountability.
- Results of the audit process indicate that management is unclear as to whether it reports to the Board of Directors, to PEPCO or to MWP. Partly because of this, outside governmental as well as political pressures are commonly and effectively exerted on PESCO senior management – which is itself selected by PEPCO and not by the Board of Directors.
- There is a lack of transparency in hiring and career advancement within the utility. Clear and transparent HR-related rules and regulations are lacking, without the necessary checks and balances in the system to foster an atmosphere of fairness and impartiality with respect to the annual performance review process.
- The compensation system makes no distinction between "performers" and "non-performers," nor does the system adequately reward high risk jobs, such as linemen.
- PESCO salaries are artificially low as an result of continued adherence to WAPDA salary scales, but while this may result in savings to DISCO operating cost, this is in fact artificial saving; one cannot expect employees who are perennially underpaid to function at high levels of performance. In other countries, low compensation levels have been linked not only with poor performance, but also with tendencies to engage in corrupt work practices.
- The company has not yet drafted updated job descriptions for senior management and key staff positions. Rather, the position descriptions for senior management remain the archaic Area Electricity Board position descriptions. These documents lack clear and specific descriptions of roles and responsibilities, required educational background and professional experience, core competencies, and scope of authority and responsibility.
- While PESCO provides capacity and safety training at a central training center, the linemen trainees are trained with tools that are not commonly provided to line workers. The line workers are, in general, not provided basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective fashion.
- Health coverage for employees and their dependents is poorly structured and imposes considerable hardship on employees.

- PESCO senior management has a vision, but the vision has not been effectively communicated to mid-level management and staff. It is therefore not well understood by employees.
- It 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 and objective evaluation of performance.
- PESCO has not yet developed an Employee Handbook.
- The utility does not have a comprehensive training and development action plan and generally lacks training or capacity building programs. Training that is offered is mostly aimed at allowing employees to advance within the DISCO system, as opposed to skills development. Training facilities are ill-equipped, with instructors who have themselves not been retrained in many years, and training manuals that have not been updated in two decades or more. The training program also lacks post-training impact evaluation to judge effectiveness.

2.5.3 Analysis & Discussion

Historic WAPDA hiring and promotion processes still prevail in PESCO, as they do in all DISCOs. That is, there exists a lack of transparency in the hiring and career advancement process, with career advancement based upon seniority rather than performance, and hiring often dictated by external agencies such as the Ministry and PEPCO. Clear and transparent HR-related and other rules and regulations have not yet been established, nor have the necessary checks and balances required to foster an atmosphere of fairness and impartiality with respect to the annual performance review process. PESCO corporate culture has not evolved to reflect a modern, independent electric distribution utility. Employees appear to be locked in a historic WAPDA/public sector mindset, where once employed, an employee continues to be in service and is promoted based on seniority, with scant regard to performance.

As in other DISCOs, PESCO 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 expertise and a variety of other skills and experience.

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

The utility lacks a clear, proactive and structured training and capacity building program. This shortcoming needs to be addressed on a priority basis. Moreover, PESCO has not yet engendered a customer oriented approach to build trust and confidence in its clients.

Modern HR Practices

Throughout PESCO, staff at all levels stressed the need for fair and transparent HR practices. The need is for an HR management system that is based upon accurate and up-to-date job descriptions, key performance indicators, and fair and rigorous appraisals. This is necessary to establish the foundation of a progressive business entity.

PESCO continues to employ old, outdated job descriptions that do not sufficiently define duties, responsibilities, qualifications, and levels of authority for incumbents. There is a need for a comprehensive review and modification process in order to incorporate main job functions, responsibilities and performance indicators.

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

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

Analysis of Manpower

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

Table 2.10 below summarizes PESCO staff statistics. It indicates that only 28% of PESCO staff have completed university, and although this number is higher than in other DISCOs but is still very low; about 65% of the workforce is virtually illiterate, and less than 0.5% are women.

Table 2.10 PESCO staff statistics.

Manpower Distribution	Strength
TOTAL	**17,204**
Total Officers	369
Total Officials	16,835
Regular Employees	16,423
Contractual Employees	761
Daily wages Employees	9
Deputation	11
University graduates	4,793
Diploma Holders	1,264
Primary, Secondary & complimentary	11,147
Female	58
Male	17,146

Source: PESCO HR Department "Data as of December 31st, 2010"
**The Data acquired in this assessment might vary from the data reflected before June 30th, 2010, due to manpower sizing, attrition, etc.*

Table 2.11 shows that an enormous number of PESCO staff – approximately 43% -- are not properly categorized by occupational streams (those shown as "Others (schools, civil works, etc.)", and are not employed in the core utility business. This leads to the conclusion that PESCO has either not assigned employees to positions relevant to meet its needs, or that it has become an employment center that pays for services that are not required. Thus it is highly likely that many services could be effectively out-sourced.

Table 2.11 also shows that the Human Resources and Administration Departments have only 35 employees, and are thus severely understaffed. Similarly, there are only 47 people involved in the training activities for 17,204 employees. All this leads us to the conclusion that 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 qualified women staff members.

Table 2.11 Distribution of employees by department

Employees by Department	Strength
Executives/ Directors	190
Human Resource & Admin. Department	35
Finance Department	283
Operations Department	5522
Commercial & Sales Department	2,284
IT/ MIS Department	200
Construction Department	591
Training Department	47
Audit Department	118
Security department	542
Others (store, school, civil, other)	7,392
Total	**17,204**

Source: PESCO HR Department "Data as of December 31st, 2010"

Table 2.12 below provides a snapshot of PESCO employee time in service. This shows that 78% of its employees have been in service for more than 11 years. This shows that a significant number of PESCO employees have been in the legacy WAPDA organization for many years, and that the challenge of changing the corporate culture will be significant. The years of service distribution is leading us to the conclusion that PESCO has not been recruiting actively in the past 10 years, and thus the bulk of its workforce is nearing the retiring age limit. The demographic distribution shows that a reduction strategy based on attrition through retirement can be an effective tool in optimizing PESCO's workforce; 68% staff have less than 15 years of service remaining, while 43% have less than 10 years remaining. Any future activity on optimizing PESCO's personnel needs to focus on this aspect of PESCO's workforce, and review the distribution of this aging workforce in detail.

Table 2.12. PESCO employee demographic profile

Year Of Service	Strength	Age bracket (Years)	Strength
0-5 years	966	below 30	550
5-10 years	2,721	30-40	2,464
10-20 years	1,471	40-45 years	2,495
Over 20 years	12,046	45-50 years	4,255
		Above 50 years	7,440
Total	**17,244**	**Total**	**17.204**

Source: PESCO HR Department "Data as of December 31st, 2010"

Compensation Analysis

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

DISCO regular employees are compensated through archaic WAPDA "basic pay scales" (BPS), a standard compensation package of the Government of Pakistan. Salary-related benefits, such as allowances, bonuses and increments are also treated under the same system. Under the system, there is no distinction between "performers" and non-performers". It does not adequately reward high performers, or jobs with high risk, such as linemen, who prefer to move to other positions or ask for early retirement.

An exception may occur when an employee is hired as a "contract employee" at the level of a Director (e.g. of HR, Legal or Finance). The pay package for contract employees is considerably higher than for core PESCO employees and is not constrained by the government BPS. Private sector employees are paid several times more than PESCO employees. For example, the CEO of NEPRA earns approximately three times as much as PESCO's CEO (see Table 2.13). A still more striking comparison is that a newly graduated engineer who is hired from the private sector would draw a salary equivalent to that of the CEO.

Comment [I1]: Incorrect statement; present Dir, Fin is thru PEPCO.

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

Table 2.13 Comparison of PESCO and other institutional salary levels.

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

Source: NEPRA Accounts Department, PTCL & NESPAK HR departments as of December 30th, 2010

Organization

The organizational structure employed by PESCO is designed to employ distribution circles as large geographic management units that are managed as full service utilities – minus engineering planning. Circles are managed by Superintending Engineers who are empowered with responsibility to manage all operational activities except planning and engineering functions, which are managed at the PESCO 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 department measures the success of the operations department and therefore must be independent; it is best managed by managers and staff with the educational and experiential background, as well as the institutional objectives, for optimizing distinct functions. Commercial activities are targeted towards 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.

PESCO'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 company - financial sustainability. Under the present structure, the CEO has far too many direct reporting staff, including all senior operating personnel. Engineering planning, utility operations, commercial functionality, administration and financial management should be managed on a day-to-day basis by highly competent managers without CEO involvement, other than to set objectives and review progress towards these higher level achievements. The assessment at PESCO showed that some of the key managers at PESCO are overworked, e.g., the Director Finance is currently holding 3 key posts, namely those of Finance, Tariff and Company Secretary.

Human Resources Organization and Management

In additional to functionality challenges, the human resource department is faced with organizational issues. First and foremost, the HR Director has a dual responsibility to oversee human resource activities and also be responsible for administrative work (security, fleet management, facilities management, etc.).

All HR functions are currently managed in the PESCO head office; there are no HR representatives at the circle level of PESCO. The company relies upon administrative staff to manage human resource issues at the circle level, but these employees have no training or expertise to conduct HR training activities or to advise employees on their rights and obligations to the utility.

PESCO has not yet established a human resource information system that would allow it to digitize all HR data, reports, personnel files, performance management programs, etc. This has become an essential feature of modern human resource management functions.

Health and Safety

The records of the previous three years (table 2.14) show that PESCO has a poor record of safety in its operations; there have been 48 fatal accidents in the past 3 years. It is encouraging to see that the number of fatalities have gone down on a yearly basis over the past 3 years (down from 22 in 2007-2008 to 12 in 2009-2010); but there is still need for improvement. The accidents met by the public are not available with PESCO, and therefore could not be analyzed.

Safety training does not meet the needs of line workers as evidenced by the high number of injuries and accidents in recent years at PESCO. It has not developed a safety program with policies and procedures that govern linemen working conditions, provide ongoing training, an incident reporting system to record and evaluate all workplace injuries, and enforcement practices / procedures for safety in line construction, maintenance, and system operations.

Safety is not given is due importance either for PESCO employees or its consumers. Safety training to advise consumers on the proper use of electric power – and the risks involved in inappropriate contact

with power systems – has not been adequately addressed. PESCO has therefore not yet sufficiently developed and deployed safety awareness programs.

A safety program will require a significant investment in training, protective clothing, tools and program monitoring. It will require a cultural shift in the workplace, aimed at to dramatically reducing accidents and deaths. In addition, PESCO employees would benefit from a diversification of health care options, moving away from the WAPDA health facilities as the primary provider of services to increased options providing primary care for employees and family members.

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

Table 2.14 PESCO accident rate of last 3 years

Year	Events	Fatal	Non Fatal
2009-2010	28	12	16
2008-2009	28	14	14
2007-2008	20	22	8

Vision and Internal Communications

PESCO senior management has a vision, but the vision is neither well communicated nor understood by employees at the lower level. The PESCO organizational structure should include management units with clearly defined objectives and linkages, each serving the goals of the company, contributing to its growth; and the plans for making this into an autonomous entity. In particular, a Health and Safety Directorate needs to be established, with higher levels of responsibility; the Company Secretary office should be separate and not under HR- it could also be entrusted to handle corporate and legal affairs; the training and staff development units should be upgraded with clear lines of duties and responsibilities, aligning staff training needs with those of the utility. It will also be useful to establish a strategy, business and manpower planning unit, to look into medium and long term plans and anticipated changes, aligning PESCO's progression into an autonomous entity.

Recruitment

Effective recruitment begins with well-defined job 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 from both within and outside PESCO.

As mentioned above, the position descriptions even for the most important jobs in PESCO are not well defined, not specifying core competencies, required educational background or levels of responsibility. They are too general to be effective in guiding the recruitment process.

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

Lastly, the recruitment process itself is often short-circuited by direct appointments made by PEPCO and/or the Ministry of Water and Power. This practice violates the concept of an independent electric distribution utility, and has forced PESCO and other DISCOs to absorb professionals into positions for

which they are likely not well suited. 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 that are selected. In 2009-2010, 973 or 62% out of a total 1,560 new recruits were based on this quota, while 74 (or 4.7%) posts have been allocated to dependents of deceased employees, leaving only 513 candidates (or 32.8%) to be recruited based on merit. It is imperative that fair, transparent policies and procedures be adopted to address issues such as these.

Performance Management System:

PESCO does not employ a corporate performance management system. In 2009, PESCO (as other DISCOs) changed the annual evaluation system from the ACRs – (Annual Confidential Reports) to Performance Evaluation Reports (PERs). The ACRs were confidential, in that even the rated employee was not privy to evaluation. The PER, which is essentially the standard annual performance review program proposed by PEPCO, uses a different format but essentially has the same weaknesses. It lacks goal setting and objective evaluation of performance. The report, unless negative, is seldom shared with the employee.

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

HR Policies and Procedures

PESCO has not developed a consolidated and easily accessible set of HR policies and procedures manuals for staff and management. From recruitment to termination, clear cut rules and procedures are required. In place of policies and procedures that serve PESCO needs as a large and growing corporate entity, the utility has continued to employ legacy WAPDA HR policies rewarding longevity and seniority, rather than high performance and dedication to PESCO's mission. Many of these policies and procedures date from the early 1980s, and in some cases have little relevance to high functioning electric distribution utilities. The longest serving HR Department staff usually knows almost all rules and where to find them. Other staff, particularly from outside the HR Department is therefore at a considerable disadvantage, being dependent upon the HR Department even for minor matters such as leave regulations, etc. In such a scenario, HR operations that are transparent and equitable simply cannot occur. Where proper policies or procedures do exist, there is inadequate implementation, allowing influences, both internal and external, to intervene.

Employee Handbook

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

Employee Health Coverage

The health coverage for the employees and dependents is poorly structured and involves considerable difficulties for them.. There is a lack of choice for employees or their dependents to obtain medical care (out-patient and in-hospital) of their choice. Employees and dependents are forced to use the WAPDA central hospital, or a peripheral health care center at the circle level, requiring considerable travel.. These centers are ill-equipped, poorly staffed with unqualified health care practitioners, and often do not possess the facility or required services. Alternatives such as better health care through insurance or paying a fixed

proportion of salary for outdoor treatment, have not been evaluated or brought up for serious consideration.

Training and Capacity Building

Like the regional training centers (RTCs) at many DISCOs, the PESCO RTC in Charsadda requires substantial rehabilitation, both in terms of the building and its training materials. Based on discussions with training staff at the Center and visits to its facilities it is clear that training tools, manuals and other aids are inadequate to meet the growing needs of the utility. For instance, linemen are trained with tools that are not commonly available or provided to line workers. The line workers are in general not provided basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective manner.

PESCO does not have a comprehensive training and development action plan and generally lacks training or capacity building programs. The training that is offered is mostly targeted to allow employees to advance within the organization, that is preparing them for promotion; in 2009 only 983 employees were trained which increased to 1,011 employees in 2010.

Training is not effectively oriented towards substantive skill development. PESCO has not planned or implemented an effective needs assessment plan required to design future training programs. The training facilities are ill equipped, with instructors who have not been retrained in many years, and training manuals developed in the 1980s (under a USAID program) and not updated since. The training program also lacks a program to perform post training impact evaluation.

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

Commercial training:

1. *Meter reader training.* This should focus on familiarizing meter readers with new metering technologies; with handheld electronic meter reading devices; to identify and record meter faults, meter tampering and meter maintenance requirements; and to carefully record and transcribe data.
2. *Improving basic computer skills for commercial staff.* This would dovetail with ERP implementation, to ensure that commercial staff understands how to specifically manage new levels of responsibility using ERP screens, troubleshooting functions, modification of customer information, printing of modified bills, and other basic tasks associated with an advanced commercial customer information and billing program.
3. *Customer service training.* This would orient commercial staff to think of and treat customers as valued clients.

Engineering & Operations training:

1. *Safety management program.* Establish a safety management program, and provide basic and advanced safety training to DISCO linemen and line superintendents.
2. *Work planning management.* Train line crews to work more effectively to complete tasks in a timely manner. 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 PESCO staff could and should develop improved manual mapping and planning tools.
4. *Line design.* PESCO and other DISCOs do not actually design distribution line. Rather, they use rules of thumb as proxies for engineering design practices and 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. *ERP training.* In financial, human resource and material management functions of the new ERP system. While the vendor will provide very basic training on the system, there will be a need for more detailed training across a number of essential application modules.
2. *Internal audit training.* PESCO internal auditors focus on only one of several internal audit obligations as outlined in the internal audit manual – identifying low/inaccurate meter reading. Internal audit obligations are far broader than merely focusing on this function.
3. *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 human resource 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 a performance evaluation program.
4. *Capacity building for trainers.* This is an important training of trainers program.

2.6 Communications and Outreach Assessment

2.6.1 Overview

PESCO is serving a diverse base of internal and external stakeholders in Khyber Pakhtunkhwa. The existing communications and outreach practices at the utility are a continuation of the policies of its predecessor public sector organization which rely on rigid protocols of restricted availability and access to information. Given the existing state of communications practices, ensuring fast and efficient internal communication is an uphill task for a large organization like PESCO.

PESCO has an active Public Relations Department, dealing with the media for information sharing and press releases, given its limited control over resources. The utility has not been able to build a favorable corporate image despite its wide network of customer services and responsive complaint handling system. Furthermore, frequent power outages and tariff increases have made an adverse impact on its consumers.

This section analyzes the context of the internal and external communications and outreach practices of PESCO and offers recommendations for priority areas.

2.6.2 Summary of Key Findings

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

- **Internal Protocols & Practices of Communication:** The existing communications and outreach practices of PESCO are based on rigid protocols, restricted availability and limited access to information. The culture of communication relies primarily on letters and inter-office memos forwarded through files, personal delivery, fax and post mail. Electronic mail culture is not prevalent.

- **Corporate Communications and Consumer Outreach:** Currently, external communication is not geared towards development of a corporate identity and unique image synonymous with a service delivery organization as mass media campaigns are out of its domain. The role of external communications through its Public Relations department is limited to public relations only.

- **The Public Relations (PR) department:** The PR department acts as a supporting department and reports directly to the Chief Executive Officer (CEO) with a limited role in external communications and campaigning. Its main job is to liaise with the local media on behalf of the company and manage the release of company announcements, public and procurement notices. It also monitors the media for relevant coverage.

- **Media Mix and Products:** PESCO does not maintain an annual corporate communications plan and calendar of activities. Only a few outreach exercises are carried out, most of which are need-based rather than planned corporate activities.

- **IT Penetration:** There is very low penetration of computers, networking and electronic communication. Electronic mail culture is almost nonexistent despite assigning of official email addresses and computers to most of the managerial staff. The available computers are mainly used as an alternate to typewriters or for data processing. Not many efforts have been undertaken for digitizing data, procedures, rules and regulations.

- **Customer-centric Communications:** The staff handling customer complaints in person, or designated at the helpline number, are not trained in customer service communications skills and etiquette. Most of the customer service centers lack connectivity and do not use information technology for record keeping and analysis.

2.6.3 Analysis and Discussion

Being a service-delivery organization, PESCO continues to face countless problems; including the ever-widening gap in the demand and supply of electricity, adverse customer response to tariff hikes, rampant power theft, low recovery and a peculiar political environment characterized by deteriorating law and order situation. It is headed by a Chief Executive Officer and is governed by its newly established Board of Directors. The two most crucial external stakeholders of PESCO are PEPCO and NEPRA, being the administrative and regulatory bodies respectively. PEPCO has a peculiar role in national electricity governance and, hence, exercises its influence over PESCO in terms of overall communications and outreach policies and practices, whereas NEPRA has a regulatory role in the electricity governance.

PESCO serves millions of customers with a vast network of sub divisions, divisions and circle offices as well as customer service centers to address the electricity complaints of a large customer base. Frequent power shortages and increase in tariffs are important challenges for PESCO, more visible since the last few years. Resultantly, PESCO has been facing much of the customers' anger due to the factors which are beyond the domain of PESCO. As such, it is a difficult task to satisfy the customers as well as maintain a credible corporate image.

In a large organization like PESCO, employing effective internal communication is a daunting challenge. The task assumes more significance due to the fact that existing communication and outreach practices are the continuation of a typical public sector organization relying on restricted availability and access to information and minimal digitizing of data, procedures, rules and regulations. The culture of communication in PESCO relies primarily on inter-office memos which are forwarded through inter-office files, personal delivery, fax and post mail. The electronic mail culture is not prevalent.

Penetration of information and communications technology is extremely low. The available computers are reportedly used as alternates to typewriters or for data processing needs. Senior management do not use e-mail as the preferred tool of communication. The visiting cards of personnel do not mention the web page and email addresses. The core function of the MIS department is data management of bills and

printing. Its role has never been extended to promoting electronic communication practices in the company. However, this department has the capability to implement a digital transition in the company if vision and resources are provided.

The senior and middle management were found well aware of the challenges of internal and external communication and determined to deliver as much as they could with available resources and flexibility. However, their potential capability was overshadowed due to the overriding policy influence of PEPCO and MWP, as well as constraints of resources and management authority, besides their continued pre-occupation with ongoing issues of governance and technical matters that require continuous attention.

With due recognition of existing corporate strengths and practices, the following findings emerged during the internal and external communication assessment of PESCO, which also highlight the gaps for improvement:

Status of Corporate Entity – Assumed versus Actual Autonomy

The present status of the Distribution Companies (DISCOs) in Pakistan is marked by contradictions. On one hand, significant steps have been taken to eliminate the monopolistic regime and create self-governing independent electricity distribution entities with individual Board of Directors. Yet the given autonomous status of DISCOs has remained largely subordinated to administrative controls by PEPCO, raising uncertainty on many levels. Experience suggests that such external pressure stifles innovation and service improvements, constraining organizational effectiveness. In order to break out of the current state of inertia, the DISCOs need to be empowered with strong institutional structures capable of resisting and dealing with external pressure as a limiting factor.

Interaction with senior and middle management and review of corporate practices revealed that PESCO is continuously following the image, practices and policies of its predecessor - WAPDA - in many areas. With its current status, PESCO draws authority for many strategic management and communications issues from PEPCO, Ministry for Water and Power and WAPDA. A few basic observations are as follows:

- Corporate communications need substantial capacity building to emerge from the aegis of WAPDA. In external communication, PEPCO appears alongside PESCO in all its advertisements. Lack of standardization of the brand image is also shown by the fact that in smaller advertisements (e.g. 10 cm x 2 columns size), the company's logo is not properly registered. These are small but significant oversights which overall dilute the company's corporate image.
- In public outreach, campaigns in the mass media are considered to be the exclusive domain of PEPCO, which decides subject matter, media mix and frequency, as well as the appointment of advertising agencies. These are strong limitations that ultimately constrain PESCO's effectiveness in consumer outreach. Another associated issue is that the utility is obliged to pay its contribution for mass media campaigns carried in national media by PEPCO.
- The overriding impression gathered from the management was that the Board of Directors followed the policy guidelines of PEPCO and MWP.

The Challenges of Communication

The prevailing corporate culture and practices pointed out serious challenges in PESCO's external as well as internal communication, which are summed up as follows:

Corporate and External Communications

- There is a lack of corporate branding and image building in external communication.
- The role of communications is restricted to public relations only.
- Corporate communications is a low priority area with limited budget allocation.

- The potential of public outreach activities has not been explored proactively, except carrying out isolated activities such as an energy conservation poster campaign.
- A regular annual communication plan and calendar of activities does not exist.
- The Annual Report has not been published for the last 4 years. However, annual financial accounts have been regularly compiled, meant for relevant internal and external stakeholders.
- The potential of a website is not being explored as a platform for corporate communications and publicity.

Internal Communications

- As noted above, PESCO follows the communication style of a government organization. This tedious process entails notes prepared by subordinate staff, approved by one or more senior officers, and returned the same way until finally a formal letter or inter-office memo is issued, with copies marked to related staff. Such letters are then numbered in a dispatch register and delivered by hand to the concerned offices. The use of more efficient means like couriers or express mail, or correspondence through email, is still highly uncommon, creating a huge challenge of efficient and speedy communication within a large, traditional workforce. Speed and efficiency are thus the natural casualties.
- There is continued resistance to the use of IT. The obsolete method of filing information also makes it harder to manage and restricts general accessibility.
- A phased plan of providing training on basic information technology to the staff is reportedly in process, though at a relatively slow pace.
- Not much has been done to build an information database (knowledge management) on rules and regulations, operations or other information of public interest.
- The implementation of ERP is not yet on the horizon, still being in the planning stage. If implemented, ERP could pave the way for improving the culture and efficiency of internal communication practices.

External Communications Process, Practices and Outreach Strategies

The Public Relations department at PESCO is the focal department for external communications and outreach activities. The department is headed by a Director (PR) assisted by two staff members, a computer operator and photographer. The Director (PR) has been working in the department since many years and appeared to know his core functions fairly well.

The Public Relations (PR) Department is not represented in the current organizational chart as an independent department. It is a support department and reports directly to the Chief Executive Officer (CEO). Its main job is to liaise with the local media on behalf of the company. The main functions of the PR department include:

- To scan national and regional newspapers on a daily basis and prepare a summary for the CEO regarding any coverage of PESCO in particular and the power sector in general.
- To prepare and issue press releases on PESCO's activities, public notices, procurement notices, shut down announcements, etc.
- To liaise with local press and electronic media for announcements and coverage.
- To respond to any adverse media query that appears in national TV channels or press.
- To keep liaison with PEPCO for corporate and external communications activities, media queries, preparation of new media campaigns and press issues relating to the Press Information Department (PID).
- To liaise with the designated advertising agency – Midas (Pvt) Limited, MCom, and Orient Mcann - for preparation of press and electronic media campaigns and media responses.
- To manage the compilation and publication of a monthly newsletter projecting corporate news.
- To liaise with local printing presses/production houses to manage printing jobs.
- To arrange outreach activities; including seminars, events, radio talk shows and press briefings on corporate and electricity-related issues.

The PR Process and Practices:

PESCO undertakes external communication at the local media level, whereas mass media campaigns are managed by PEPCO. PESCO contributes its share of media expenses to PEPCO. Main communications and outreach activities of PR department are press releases, monthly newsletter, shut down announcements, procurement (tender) notices along with conducting occasional seminars on energy conservation and press talk shows.

The PR department creates a daily media report for the CEO, responds to media stories and handles bad press. The media review is shared with other concerned departments as well for their information and input. The department prepares and issues the press releases as per the brief (usually verbal) of the CEO or any other departmental head if required. The PR department has an annual budget of up to 25 million rupees.

The PR department uses a media mix which includes newspapers, TV channels and radio. Local press is the most common media used followed by radio. As TV advertisement campaigns are managed by PEPCO, the PR department does not have worthwhile activities to roll out in mass media on its own.

Review of Existing and Previous Communications and Outreach Campaigns:

The PR department creates and manages media coverage to highlight day to day information such as system improvements, customer services activities, power shutdowns and energy conservation issues etc. However, the level and frequency of this type of communications and media outreach is not significant to create noteworthy impact in the media. In short, the outreach activities are quite limited, sporadic and fragmented without any significant impact on consumer behavior.

Internal Communication Process, Practices and Outreach Strategies:

Internal communications emphasizes on tedious and unnecessary paper-pushing apparently to complete one's own file. Audit requirements and litigations make a strong case to maintain traditional file-driven communications culture.

Historically, managers depended upon typists or stenographers to prepare their communication and maintain the record thereof. Despite the change of technology and typewriters becoming obsolete, a similar pattern is still being followed. Now that computers are used in most cases as replacements of typewriters, stenographers became redundant as prime correspondence operators and are now working mostly as personal assistants to their respective managers. It was reported that most of them have not been re-trained in computer skills mainly due to their own reluctance to part with the comfortable jobs of assisting senior and middle managers.

It was reported that management in general is not computer-friendly and, in many cases not computer literate. A knowledge management system comprising of reliable database of employees, rules and regulations and operations is not available for ready reference. This forces the employees to rely on traditional "file culture" which hinders prompt, speedy and clear communication in most cases.

There are a few reported outreach activities mainly related to staff gathering on some special occasions, usually to bid farewell the retiring employees or participate in staff welfare-related events. No other activities have been reported like events, commemorations, seminars, family gathering, staff functions/gathering, open houses, etc.

Customer Complaint Centers and State of Communications with Consumers

PESCO has customer complaint centers at circle, division and subdivision level. It was observed that staff handling customer complaints in person, or designated at the helpline number are not trained in customer handling and etiquettes of customer-centric communication. It was also reported that dedicated staff is not allocated at circle, division and sub division levels; rather staff at field customer services offices mainly

belongs to field operations and is made duty bound to attend customer services centers for a designated time period.

Monthly reports of complaints are prepared and sent to Customer Services Department for reference and record. The manual data at Customer Services Centers could be digitized for maintaining a convenient database and subsequent data-analysis for better customer service. It was observed that customer centric training and on-line connectivity could help to create a more efficient and customer friendly environment at Customer Services Centers.

Customer services centers do not have sufficient information material such as posters, brochures and flyers, explaining process of complaint handling, chain of supervising officers and salient points of NEPRA customer service guidelines for incoming customers.

Current State of IT being used for External and Internal Communication

During the past few years, PESCO has not taken much initiative to create a positive environment for ICT development and information access. The MIS Department is mainly entrusted with bills, data management and bills printing. Cobol Language is being used in its current data processing systems. The potential of the MIS Department to initiate electronic communications culture and digitize corporate data, rules and regulations is enormous but so far has not been explored. ERP is still in the planning phase.

It was also observed that most of the computers are mainly used for data processing and typing. MIS department reported having arranged email connectivity to most of the senior and middle managers but only a few dozen e-mail addresses are in use with apparently minimal usage for official communication.

The potential of web portal for internal and external communication could be enhanced with training of managerial staff.

Customer Services and Complaint Handling with a Gender Perspective

The customer service centers are not gender-sensitive. There are no dedicated facilities for women complainants; neither staff, counters, seating arrangements nor washrooms; although qualified female professional staff is visibly deployed at the customer service center located in headquarters. However it was reported that women complainants are dealt on priority basis as per cultural norm and corporate practice.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Governance

The Board of Directors does not function effectively as a corporate board. The CEO is appointed by PEPCO, acting on behalf of MWP, rather than selected by the Board. The BOD should evaluate the merits of establishing special board committees, as well as to hire a full-time Secretary.

The Boards of Directors of PESCO and all other DISCOs were dissolved on November 22nd ,2010. The newly reconstituted BOD will need both governance and electric utility training. The training will prepare them for the challenging task of governing PESCO in a changing utility environment of Pakistan; and to advise Board members of their roles and responsibilities vis-à-vis the Ministry of Water and Power, NEPRA, and other stakeholders in the power sector.

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

3.2 Engineering

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

Transmission Network

The PDIP team did not carry out any specific analyses of the transmission network, as 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. Losses are relatively high in the transmission network at 4.5%, but this is mainly due to loading in the 66kV network, which is in the process of being upgraded.

Distribution Planning Processes

PESCO'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 geographic information system (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. PESCO could therefore have a fully up-to-date mapping and analysis system at a low cost.

Standards and Specifications

Updating standards and specifications is handled by NTDC's Design and Standards Section. WAPDA construction standards have generally served PESCO well and there does not appear to be any immediate need to undertake significant alternations in the standards, 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 Peshawar 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. PESCO 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 the procurement process followed by PESCO 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 of procurement into over 100 separate solicitations, largely diluting the benefits that could be obtained. PESCO is still using the legacy WAPDA category system which tends to break procurements in to a large number of individual solicitations. When WAPDA was a government agency, this was necessary to ensure that all vendors received some portion of the orders, but now that PESCO is corporatized, it is less appropriate. The need to handle such a large number of solicitations also introduces a considerable overhead burden on the company.

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

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

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

Construction Quality

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

One practice of the construction department that does cause failure in service, as reflected in the frequency of maintenance calls, is the failure to use connectors on jumpers and other joints. It is clear that at one time, PESCO construct cadres did use connectors, but no new installations have them. All joints appear to be made with wrapped or "served" aluminum strands. No matter how neatly this is

done, it is bad practice and will result in a failure of the joint, especially if it is a high current LT joint. The standard connector specified by the WAPDA construction standards is a two bolt aluminum parallel groove connector, which is admittedly expensive. However, parallel groove compression connectors are cheap and simple to install with hand operated tooling, and provide far superior connections with much lower resistance than wrapped joints.

Operations

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

The PDIP engineering team found that at the subdivisions procedures exist for almost all tasks, but subdivision staff are slow and lack interest in compliance, particularly with such record keeping tasks as measurement of transformer loading and rebalancing. Their success is reflected in the generally low level of transformer overloading identified during the mapping and sampling process.

The PDIP engineering team found that the subdivisions are both understaffed and under equipped 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 are inadequate in quantity. There are no tools such as blocks and tackle for lifting, handlines for transferring items up the pole, or wire handling tools such as grips and come-alongs for tensioning conductors. Tree trimming equipment consists of an ax, while trimming shears and pruning hooks are mainly ornamental and too dull and weak to be of value. Transport is limited and most jobs are handled by the linemen traveling on their own motorbikes.

In addition, safety emphasis is very limited with no recurrent training, no safety meetings, and no safety program for enforcement of safety rules. Protective equipment such as safety belts and grounding sets are of poor design that do not serve the required purpose. The result is a startlingly high fatality rate among linemen and unwillingness on the part of assistant linemen to undertake the tasks of climbing linemen. Linemen fatalities are blamed by management on a refusal to wear protective equipment, but the PDIP team finds this an unconvincing argument at best. Safety programs must have enforcement provisions, but it is the responsibility of management to provide appropriate equipment and recurrent instruction in its use and 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 – where and when electronic meters have been installed. However, the large majority of the PESCO meter fleet remains electro-mechanical. Innovative power thieves have succeeded in violating electronic meters, but there is no question that they are more resistant to tampering than the older electromechanical meters.

However, the primary threat to meter security is not the meter itself, but continues to be the service drop and the connections to the meter, which are completely unsecured, as well as the LT network which is still composed of bare conductors. PESCO has taken no steps toward providing improved security for exposed connections and service conductors and for conversion of vulnerable LT to covered conductors.

Another concern is the existing fleet of electromechanical meters, numbering in the millions that are still in service on the system. These meters were in most cases not highly accurate to begin with and age has not improved their performance. These meters 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 PDIP team carried out a mapping and modeling effort on a sample of the feeders, transformers and LT networks in the PESCO 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 PESCO were found to be 13.4%, broken down as follows:

- Conductor Loss 8.8%
- Transformer Loss 2.1%
- LT Network Loss 2.3%
- Service Loss 0.2%

This level of technical loss (13.4%) can be compared to the total distribution network loss of approximately 32.6%, indicating that commercial losses are in the order of 19.2%. This shows that PESCO's major challenge in loss reduction is in both areas of technical as well as commercial loss.

Opportunities in Loss Reduction

The opportunities for loss reduction in PESCO are almost equal for technical and non-technical loss.

Mapping and Planning Improvements

- Generation of a detailed load forecast. Load forecasting, when driven by demographic and economic information, can help identify areas where attention is required.
- Use of GIS for mapping. Introduction of GIS for mapping will speed the process of generating useful maps and eliminate much of the manual labor involved in the current process. Use of GIS will allow the automated transfer of system information to advance planning software, speeding the production of integrated plans and allowing the planning staff to identify areas in which interventions are required for loss reduction.
- Application of advance planning software. Advanced planning software that accepts digital input from GIS databases and has a graphical output can speed consideration of alternative system designs and assist in developing integrated distribution plans. Use of such software will allow for consideration of potential problems before they result in high losses or poor service quality.

HT Improvements

PESCO's average feeder length is almost 46km, 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 15% of PESCO's technical loss, and technologies exist to cut even the current new specification losses substantially.
- Review of long feeders (over 46km 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, does 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 has no security at all. Neutral concentric cable encloses the cable in a grounded sheath so that any attempt to penetrate the cable with a sharp item such as a nail 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 which have larger high current connections, allowing them to be applied for direct reading up to 320 amps. This would reduce the number of CT type meters that have to be installed, removing the CT accuracy as an issue.
- Replace most of the current stock of CTs in use in industrial metering boxes with either direct reading meters or higher quality CTs. There have been a number of instances of CT failure, which of course compromises the meter reading.
- Work with meter manufacturers to improve the security of indirect meters (CT and CT/PT installations). The current crop of electronic indirect meters can be reprogrammed from an optical port to alter the meter multiplier. This creates a vulnerability to any person with the correct software and the optical programming wand, all of which can be obtained at low cost in various markets.

3.3 Financial Management

While PESCO collections are reportedly at 84.2% for private consumer energy sales, reported collections were at 53.8% for government clients in FY 2010. Given PESCO's role as a quasi government agency, it has proven impossible for it to treat government clients on an equal commercial level to other clients, which can be analyzed due to the present litigation between PESCO and the Govt. of KP. Due this un-necessary litigation, the consumer end tariff could not be increased for the last two years.

As reported in the results chapter of this report, PESCO has a reasonably effective arrangement with the banking system and other local payment methods to collect funds from its consumers. This ensures that collections are managed effectively and relatively efficiently. However, there are two issues with the collection system that is being used. First, many collection points – including some banks – retain customer payments to PESCO for much longer than they should. The pay points should transfer funds on a daily basis, but many retain the receipts for as long as a week. Approximately 64% of cash receipts are received on the same day they are paid to pay points at the PESCO principal bank account. Approximately 22% of cash receipts are received through offline banking transactions which involve a 2-3 day delay in getting to PESCO's account. The remaining 14% are receipts from post offices which may take a week. Remittance of these funds from PESCO to the CPPA in payment of purchased power is important, and creates a significant loss from the perspective of the CPPA.

Should PESCO invest in an ERP solution, this 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 company operations. Enterprise systems offer the opportunity to convert manual business and distribution operating systems to electronic, computerized management systems. This will be important as PESCO transitions into customer information and billing systems, geographical information systems (GIS) and applications.

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

PESCO needs to expand and enhance internal audit practice and procedures that were established in 1985, and have not been updated since then. The archaic WAPDA audit manual is too narrow in scope to effectively audit PESCO's financial and functional activities, and will not be sufficient to perform auditing procedures in an ERP environment.

It is interesting to note that the internal Audit Division has only partially complied with the scope defined in the existing Audit Manual, that states, "Internal Audit Division 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 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.

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

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

- PEPCO has currently placed a ban on the purchase of new vehicles when almost one third of the vehicle fleet is 20 years old or older.
- PEPCO is the de facto authority for approving ERP implementation and certain hires and new positions.
- The receivable amount from TESCO is Rs 22,511,869,499 as on June 30, 2010 relating to use of system charge only, although NTDC is billing PESCO for energy used by the TESCO network. This huge amount of receivables has seriously questioned PESCO's status as a functioning utility.
- All DISCO investment projects are required to be filed with the Planning Commission (PC), Central Development Working Party (CDWP) and Executive Committee of National Economic Council (ECNEC) for approval regardless of funding status. A very burdensome process.

PESCO has significant financial vulnerability due to lack of insurance coverage on its facilities. Only grid stations and certain new vehicles are covered.

Recommendations

- PESCO should hire a consultant to revise and update accounting and internal audit manuals in line with the movement to modernize PESCO, to increase the internal auditing scope to more effectively serve the needs of the Board of Directors, and to adjust to the new ERP environment in future.
- Evaluate means of improving transfers from pay points to PESCO bank accounts.
- Initiate implementation of the ERP platform, and expand applications to serve all finance and accounting needs in line with control, management and financial reporting to the PESCO Board of Directors, NEPRA and the Ministry of Water and Power as needed. This would include developing an in-house IT support structure which would accommodate the service needs of the organization.
- Implement ten year financial forecasting to assist in the preparation of the DISCO's Business Plans.
- Effective follow-up for the early resolution of large amounts of receivables from TESCO, Tariff Subsidy and GST receivable.
- Obtain insurance coverage for buildings, equipment, inventories and such other assets as deemed necessary to eliminate exposure to significant financial loss.

- Like its sister DISCOs, PESCO 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. The only available source of funding available to PESCO is through International Donor Agencies. Often the proceeds of loans by the World Bank or ADB, such government financing is not reliable or predictable, nor is its availability dependent on the financial strength of the DISCO itself, thus reducing the requirement for internal fiscal discipline. The shortage of reliable, reasonably priced investment capital has a significant impact throughout the organization, reducing the emphasis on long range planning, in favor of ad-hoc arrangements. Such dependence on government financing must end if the utility is to be able to reliably carry out its obligations to its consumers and function as a true corporate entity.

3.4 Commercial Management

The shortage of meters affects the ability of PESCO to recover sufficient funds. New connections are delayed; defective meters remain in use. Although some customers are billed on an estimated basis, it is likely that their consumption is much greater than the amounts billed. The lack of support from civil authorities makes it difficult for PESCO to disconnect defaulting and illegal consumers which affects the recovery of funds. This lack of support also hampers its ability to carry out normal business functions. The lack of security in certain areas affects customer service. The lack of service decreases the willingness to pay.

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

The meter reading practices currently employed are subject to influence by the 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 PESCO. Use of automated meter reading (AMR) meters; prepayment metering technology; handheld meter reading technology; and other advanced communication and metering technology would eliminate reading and transcription errors, and reduce vulnerability to meter employee and consumer manipulation of metering data. Use of AMR meters for industrial clients and transformers would make energy accounting more readily available, and would support work planning and analysis of the distribution infrastructure.

Adequacy of error detection practices

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

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

Record keeping is incomplete if done at all. Registers are not maintained in some subdivisions. Those that are maintained are incomplete and make no note of actions taken. Without complete registers it is impossible to reconcile items such as new connections with the number of bills issued. The lack of record keeping hampers PESCOs ability to favorably settle the few cases that do make it to court.

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

Billing cycle and energy accounting

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

PESCO billing, collection and financial transfer procedures are common business practices for a manual system that could be made more 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 PESCO 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 for the DISCO.

Improved consumer service

With the decreased security in many areas of PESCO, customer service is deteriorating. 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, only the SE has authority to clear complaints, leading to the need for the consumer to make repeated visits to the utility office 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 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 Customer Information System (CIS) will require new accounting, data collection and transfer, and billing procedures. Best practices require that a consumer census be taken to populate the CIS database with accurate information.

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

1. Consumer census to verify/add consumers.
2. Installation of a new Customer Information System.
3. Reorganization of corporate structure so that all commercial activities are reported 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 programs.
9. Establish systematic meter repair, testing, and calibration.
10. ***Establishment of an effective mechanism to manage recovery of huge receivables especially from the private customers at the earliest.***

3.5 Human Resource

HR policies and procedures have remained stagnant for the past two to three decades, and currently these do not support PESCO needs to attract and retain highly skilled, dedicated and engaged employees. Staff have consistently stressed the need for change and intervention in this area.

While capital investment in human resource development will be required, the primary investment that is needed is to develop improved human resource management systems, policies and procedures. This will require the full engagement of PESCO management to ensure that rational policies are not only promoted, but are integrated into the company's culture.

These policy changes that are defined will require substantial buy-in from PESCO management and staff. Some of the changes will be back-office in scope, such as redefining job descriptions, a comprehensive compensation study, and hiring and advancement policies. Others will require a high degree of retraining, communication with management and staff, and some fundamental changes in corporate culture.

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

Increasing the salary levels to bring them more in line 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 PESCO 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 performance management program, together with revised job descriptions, setting goals and objectives for all staff positions; and establish mid-year and annual evaluation review processes, measuring employee performance, and rewarding employees based upon performance.
2. Modify the recruiting policy to ensure an objective, transparent and unbiased recruitment process.
3. Revise the compensation and benefits system and package, making it attractive and competitive; a detailed market study will be required to devise a new package, and in selecting an effective methodology, whereby the new package is introduced in the DISCO. For instance, that the new higher package is offered only to those employees opting to accept the new terms and conditions of employment, including performance etc.
4. Develop training and development culture and programs; and upgrade current training facilities (Regional and Circle Training Centers). This will have the effect of making training more attractive to and more valued by the employees.
5. Introduce more advanced information technology for use in human resource management, as well as in training facilities.
6. Review and revise PESCO's benefit plan, including the employee health plan to increase flexibility and choice of health care providers and facilities. Evaluate the introduction of a health care insurance policy.
7. Evaluate staffing levels vis-à-vis international best practices. Develop staffing plan to reduce staffing levels in conjunction with outsourcing and reduction through attrition program. A review of the total work force shows that a large number of employees are in non-core functions, areas, which could easily be out-sourced.
8. Establish a robust lineman safety program that provides structure, incentives, and discipline for all linemen employees. Ensure that linemen are provided and required to use proper clothing and safety gear while performing construction and maintenance tasks. It will be the DISCO's social responsibility that the safety message is extended to the public / customers, through an out-reach program.
9. Evaluate the housing allowances for employees residing in rural areas to attract the best resources for these areas.
10. Based on the far flung rural networks being served by PESCO, we propose that the utility place increased emphasis on recruiting local personnel to serve in remote areas of the PESCO grid system. This will provide it with the right personnel from the rural areas willing to live and work there.

3.6 Communications and Outreach

Based on the findings of the Communications and Outreach Assessment, it is proposed that a gradual change in policy should be adopted with the first phase of change focusing on managerial staff. The following recommendations are outlined:

- An integrated PESCO-specific communications strategy should be designed, outlining key objectives and target audience along with a comprehensive action plan and budget to develop effective external communications and outreach for the company.
- The Public Relations Department should be strengthened to undertake an enhanced decision-making role in external communication; and provided with a regular budget to plan and execute corporate image building and mass media campaigns at the local level. The name of the department should be changed to one commensurate with its larger role in external communication.
- An Annual Calendar of outreach activities should be developed. Issues 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 and collaborative events are examples of the exercises to be carried out on a regular planned basis.
- Promote and encourage development of intranet intended to be a resource for staff with department-wide standards for documenting and storing information for easy access and retrieval. Once databases are developed and mechanism of regular updating is in place, access of information to different managerial levels may be decided as per job requirements. Managerial staff should be encouraged to use the database, avoiding the prevalent practice of extracting routine data through individual data pockets of inter-departmental communication.
- Promote a coherent corporate brand identity and develop standard templates for stationery, file folders, visiting cards, publications, etc.
- Gradual penetration of information and communications technology at PESCO should be planned to ensure that all managerial staff is provided desktop or laptop computers, imparted training of basic IT skills, networked within and inter-departments and mandated to use e-mail as a prime communication tool.
- An interactive web portal should be developed as a vehicle to promote ease of information access and communication with external stakeholders. A fortnightly or monthly e-newsletter must be developed to keep its customers aware of PESCO's activities.
- Dedicated and/or trained staff should be deputed at customer service centers to abandon the current practice of mainly depending on field duty staff. Gender-sensitivity in such centers must be ensured by providing separate windows, wherever possible, along with separate seating arrangements and public utility services for incoming women to lodge their complaints. Female staff should be recruited in the dedicated work force up at circle level customer service centers.
- Staff should be imparted training in soft communication skills including business communication, interpersonal communication, reporting techniques and corporate relations.

APPENDIX: AUDIT METHODOLOGY

A.1 Overview of Data Collection and Process Assessment

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

The operational audit for the DISCO will follow an identical process to audits undertaken in the other seven DISCOs. The process will collect and evaluate data for four areas of electric distribution operations, including:

- DISCO Governance
- Organizational Review
- Engineering & Operations
- Financial Management
- Commercial Management
- Human Resource Management
- Communications and Outreach

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

A.2 Governance

In addition to reviewing DISCO operational activities, the PDIP team will review the DISCO governing board policies, procedures and practices. With increased emphasis being placed on providing a governance structure with a higher degree of operational independence to the DISCOs, it will be essential to evaluate the changes that are needed to better support board composition, qualifications, training and other characteristics.

Towards this end, the PDIP team will review the following documents and board actions:

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

- Review and analysis of board composition focusing on the issue of ensuring its independent governance and adequate local representation thereon.
- Review of board member appointment process, tenure and terms, and process of removal (if warranted).
- Board member qualification requirements.
- Training/orientation provisions for new board members.
- Periodicity of board meetings, and provisions for extraordinary board meetings.
- Board member fee structure – are board members reasonably compensated for their participation?

The purpose of this review will be 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 will review the management and organizational structure of each DISCO with the goal of assessing the efficacy of the institutional capacity to effectively manage its human resources, physical assets, and business systems based upon the organizational structure. The review shall include an evaluation of the following organizational issues:

1. Analysis of organizational design & structure.
2. Review of PESCO departments and divisions.
3. Review of key managerial positions and their descriptions.
4. Assessment of managerial and functional competencies.
5. Review of organizational chart and 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 consists mainly of an evaluation of the contribution of transmission losses to overall system losses. In the event that transmission losses do not constitute a significant component of overall system loss, the evaluation will be truncated. In most cases, the transmission networks of the DISCOS are quite robust and are not a source of problems and therefore it is expected that this segment of the evaluation will be very limited.

A.4.2 Distribution System Management

Evaluation of distribution system management will consist of a series of interviews with staff from the Planning and Design, Construction, Operations and Procurement Departments. During these interviews the DISCO staff will respond to the team's questions and provide insight into the technical operations of the utility. These interviews will inevitably be 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 will include:

- 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 will select 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 will be 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 will review transmission and distribution-system performance data to the extent that it is 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 will then select a group of feeders from the record provided that, as a whole, represents 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 will be selected by a random number process so that each feeder has as much chance of being selected as any other. This will enhance the potential that the set of feeders will be truly representative of the system as a whole.
- 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 DISCO feeder population.
- The sample feeders should have complete data, including total sales and feeder input data, total length. Feeders with data anomalies would be excluded.
- Total feeder length will be 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 have been chosen, a total of no more than six LT networks will be chosen for detailed analysis. Because data is limited for LT networks, it will be necessary only to specify that the LT

networks chosen be fed by the selected feeders. To the extent possible they should be chosen randomly from the set of general service distribution transformers on the selected feeders.

11kV Feeder Mapping and Analysis

Once selected the 11kV feeders will be 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 is 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 will be 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 will be 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 will not permit data on actual loading to be used in the model. Instead, the feeder peak load will be 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 would be 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 will obtain station log sheets from the period around the feeder peak. Estimated average hourly power factor will then be 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 are established the feeder power flow analysis can be carried out. Losses can then be developed for each feeder for conductor and transformers. 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 will differ 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 will be necessary to covert 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 will be 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 is 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.

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.

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 will be 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" will be 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 will be applied to all components of loss.

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

Validation of Results

In its report to the Ministry of Water and Power of October 2010 each DSICO reported technical losses and non technical losses. Because these values may be at variance with the results computed by the sample technique presented above, it was decided to carry out an independent evaluation using a benchmarking technique developed for electric systems in the rural US. Studies conducted by the Rural Utilities Service, the financing and monitoring arm of the US rural electric program have determined that for systems using conductors and voltages typical of good engineering practice, distribution system loss is a complex function mainly of sales density, that is MWH sales per km of line. The equation developed based upon that parameter is as follows:

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

Where:

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

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

LN= Natural logarithm function

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

Applying this equation to PESCO, load versus loss analysis results are shown in the table 2.8 :

TABLE 2.8 PESCO BENCHMARKED LOSSES

HT & LT Km	Sales Density MWh/Km	Benchmark Technical Loss %	Actual Distribution Loss %
76,905	84.6	7.9%	34.1%

The results from the Benchmark loss column of the table should be comparable with the technical losses computed by the sample technique.

A4.4 Distribution Standards

The fourth and final component, which will be 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 the commercial management audit will be on the revenue cycle which includes the registration of new consumers, meter reading practices, bill production and delivery, and the receipt of consumer payment information. Other activities such as the disconnection and reconnection process, bill adjustment procedures, and customer services will also be reviewed. These examinations will be made so as to identify opportunities to increase the efficiency and transparency of commercial activities and improve the financial performance of the DISCOs . Opportunities to improve financial performance may include revisions to current procedures with technological enhancements, or replacement of the billing system with a Customer Information System to better manage customer information with records of all customer interactions in addition to preparing bills. The commercial assessment team shall consist of international and Pakistani consultants who have practical work experience with one or more electrical distribution companies, and have some understanding of utility commercial practices and procedures.

Data Collection

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

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

Strategic Analysis

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

The interventions will likely include a combination of investments in secondary distribution systems, transformers, services, and revenue meters; as well as changes in commercial system practices and procedures to improve DISCO metering and revenue recovery practices. The procedural changes may require the addition of devices that will eliminate transcription errors, speed data entry, or increase internal controls. The Commercial Specialist shall also evaluate and make recommendations regarding the effectiveness and adequacy of commercial software (the CIS), with the aim of determining if a software solution that more effectively integrates commercial, accounting, human resource, work order, and other DISCO functions would be merited.

A.7 Human Resource Management Audit

An integral part of the operational audits will include an evaluation of human resource management and HR systems for each DISCO. The HR review will evaluate DISCO organizational structure, analyze performance management systems, evaluate compensation systems, review selected management and staff positions, and perform a preliminary analysis of the training needs; specifically focusing on commercial needs and linemen training to improve productivity and safety. The HR audit will be led by the Organizational Specialist who shall be responsible for organizing and leading a team of Pakistani human resource and institutional management specialists.

The goal of the human resource management audit shall be to identify improvements needed in DISCO organizational structure and human resource management to result in an HR model that supports the long-term institutional needs of the DISCO. The model should support appropriate levels of compensation and benefits, and establish a work environment that provides the incentives needed to support a well-motivated workforce. This model should support emerging process-centric culture, and a cost delivery model that appropriately balances customer service with effective service delivery. The DISCO organizational structure should support high quality electric service and high customer satisfaction, both of which are predicated on highly motivated and satisfied DISCO employees The assessment should therefore focus on assessing not only organizational structure and key processes, but also human resource management and management systems, HR functions and the HR organizational structure in which the HR functions operate, as well as the current roles of line managers and their staff managers.

The organizational team shall review and evaluate the state of the HR management system, functions, responsibilities, performance management systems, and compensation package. The evaluation will compare the DISCO human resource management and management systems with best practices from within and beyond Pakistan, from which recommendations will be made regarding how the policies, practices and procedures can be improved to enhance the productivity of each DISCO. The organizational assessment team will use diagnostic tools to identify gaps in optimal DISCO personnel performance. Data will be collected through interviews and surveys to take a baseline of current policies and practices; this will be contrasted with best practices to define the actions that are necessary through the DISCO Performance Improvement Action Plans to result in significantly improved human resource policies, practices and management systems

Data gathering shall include:

1. Internal interviews 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 DISCO administration at the Division and Sub-division levels to include roles and responsibilities, adherence to existing DISCO procedures, including health and safety, and any other standard operating procedures that exist within the DISCOs.

Review of HR strategic and functional analysis includes:

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

Evaluation of training and capacity building needs will:

1. Develop a training needs assessment survey form.
2. Conduct a training needs survey by distributing needs assessment forms to functional heads to determine critical skills & competencies gaps. The same will be translated into the launch of an urgent training program through performance improvement project.
3. Identify essential and immediate training needs for engineering, financial management, commercial management, and human resource functions at PESCO.

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 viz-a-viz status-quo driven organizations is practice of contemporary modes of communication, openness, and scientific knowledge management to ensure efficient and speedy decision-making for the greater good of the organization.

Communication and Outreach Assessment of LESCO 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 an Action Plan, and promoting better understanding and improved public opinion of PESCO as an electricity distribution company.

The Communications Assessment includes:

1. Review and analysis of existing internal and external communication and outreach strategy, organizational 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 about onsite communication with customers in terms of customer services and complaint handling style, clarity, processing time and delivery practices. The services and handling were also reviewed with a gender perspective.
4. Review of internal communication process, feedback and follow up status to assess the efficiency of internal communication.

5. Review of current state of Information Technology being used for external and internal communication.
6. Identifying training needs for relevant staff.
7. Assessing the current practice of using various communication tools/vehicles like web site, newsletters, emails, event management and other multi layered 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 PESCO'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 LESCO as a service-delivery and customer-centric corporate entity.

Internal Communication

Internal Communication is related to communication within LESCO. 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 the 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 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 PESCO:

Interviews of key staff:

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

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

Focus group discussion:

A Focus Group Discussion (FGD) was held with managerial staff of relevant departments to discuss the cross-cutting issues of internal and external communication on similar lines to those mentioned above to ascertain feedback and comments from middle management level. Topics of discussion also included internal and external communication practices and readiness of staff to embrace contemporary communication culture.

Documentary review:

Review and appraisal of relevant records and material available with the Public Relations, MIS and Customer Services Departments was undertaken, including records of daily press cuttings, press releases, printing, and publications of the PR Dept. Similarly, practices and process of data collection, bills printing

and various output reports were reviewed at the MIS Dept. The registers maintained to record details of complaints of Customer Services were reviewed to understand the practices and efficiency of the current system.

Visit to the Customer Center:

The Customer Services Centre located at PESCO Head Office was visited to understand the complaint handling process as well as gauge the level and quality of customer service.

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