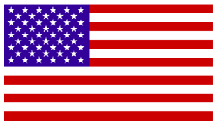

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QUETTA ELECTRIC SUPPLY COMPANY (QESCO) OPERATIONAL AUDIT REPORT

Produced by:

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

APRIL 2011

PAKISTAN-US ENERGY PARTNERSHIP

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

QUETTA ELECTRIC SUPPLY COMPANY (QESCO) PERFORMANCE IMPROVEMENT ACTION PLAN

ENERGY II IQC CONTRACT EPP-I-00-03-00006
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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 the Quetta Electric Supply Company (QESCO), 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. It commenced in September 2010. PDIP was designed to be implemented in two distinct phases:

- **Component 1** consisted of Operational Audits of each of the eight Government-owned distribution utilities (DISCOs).The purpose of these in-depth, operational audits was to establish baseline information that can be used to measure improvement in performance over time. The Audits covered governance, operational, financial, human resources, communications and customer service areas and surfaced opportunities for fundamental improvement in all these. The improvement opportunities are reflected in specific Performance Improvement Action Plans.
- **Component 2** will focus on execution of the Performance Improvement Action Plans by each DISCO, including implementation of pilot projects to demonstrate a number of key operational improvements and directly measure their value to the utility.
- QESCO has adequate investment through ADB Power Distribution Enhancement Investment Program (Tranche I & II) and with major emphasis on transmission system expansion, up-gradation and augmentation. Further there is investment under Kuwait Fund but it is limited to rural electrification and on related substations and transmission lines Therefore, PDIP focus is mainly on distribution system (11kV and below) improvement as it lacked investment

MAJOR FINDINGS & CONCLUSIONS

The Operational Audit conducted for QESCO during Component 1 provided extensive insights into how the company operates and the performance consequences of its current approaches and practices. The PDIP team also became aware of deficiencies that obstruct progress toward improvement. Part of the challenge faced by QESCO's management and board in seeking to 'bootstrap' overall performance, enhance customer

service, and create greater financial self-sufficiency will be to select the *right* actions at all levels - from front-line operations to strategic planning - and assign the *right* priorities. This summary of major findings culled from the Audit 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	QESCO's governance system has not yet made the transition to a business-like electric utility focus. It remains subject to political intervention, and the Board of Directors has not been empowered to oversee a true corporate entity. Recent reconstitution of the Board by the Government is a positive step toward greater professionalism and operating autonomy; however, additional changes will be required to enable the 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	The QESCO organization is structured primarily by geographic area and not along functional lines, the latter now 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	QESCO's transmission network is seriously deficient and a source of significant problems for the company. It cannot supply the full demand of the company, requiring QESCO to shed load even when there is no requirement for load shedding in the national grid. Transmission losses are stated to be 7.8%, and while this seems high, there is no doubt that the transmission network represents a serious source of loss. QESCO 's distribution system suffers from high technical losses due to long lines, and small conductors at the feeder departure from the substation. Poor power factor is also likely a problem, although it was not possible to actually measure feeder power factor. Although the calculated non-technical loss is not excessive, observation of the system indicates that it is probably not realistic. Meter tampering, and illegal line taps were observed during the inspection. Since much of the agricultural load is served at a fixed rate, it is possible the estimated consumption on these consumers is high, thus covering up the non-technical loss in the rest of the system. Losses will need to be brought under control in the near future to ensure long-term financial viability. Construction and maintenance work practices in widespread use among QESCO line workers 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 significant financial impacts for the utility. Preliminary loss analysis on five (5) sample feeders using GIS mapping &

	modeling technique with a load flow software shows that technical loss for QESCO's distribution system is approximately10.5 % and the total distribution loss 14.2% is a non-technical loss of 3.7%.
FINANCIAL	QESCO has significant amounts due to CPPA for purchased power. The current ratio/financial indicator suggests a significant concern regarding the company's ability to pay its current debts on time. Its material inventory balances indicate significant inefficiencies in materials management when compared to material amounts used. The company has not carried out physical verification of property plant and equipment and the most recent financial audit was unable to support management's assertion of the existence and carrying values of underlying assets. QESCO's cash flows are impacted by the lack of electronic funds transfer capability on the part of a significant number of organizations operating customer pay points. This situation works against the timely receipt of funds necessary to operate the business. The company also shoulders certain cost burdens that are rarely if ever seen among leading utilities worldwide. As a result investment in both distribution system assets and employee equipment is hampered by low capital availability, and operating performance impacted by poor cash flows. A new, rationalized financial framework covering both internal and external relationships and transactions is needed to assure better bottom-line performance.
COMMERCIAL	Progress towards a modern billing and collections systems is frozen at the most basic level of automated processing, typical of the 1970's in other countries' utilities. The entire revenue cycle, from the setup of a new customer account to meter reading to receipt of customer payments and ultimate revenue recognition, remains a highly fragmented and manual process. Inadequate monitoring of all steps in this cycle at QESCO virtually assures negative cash flow impacts, higher than necessary levels of payment arrearages, low customer satisfaction, and delays in completing even the simplest jobs. Theft of electricity and related fraudulent activity that reduces revenue to QESCO is rampant. Agricultural customers, sharing more than 75% of total consumed units, are considered the biggest challenge in terms of theft control. As per its official statement, there are around 5000 illegal tube well connections giving an annual loss of around Rs 4bn, with 170MW of additional burden, on QESCO's network. Reconciliation of customer meter readings to known area meter readings, which would highlight areas for investigation, has not been implemented. Presently, QESCO 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. QESCO struggles with lack of communications infrastructure at most of its field office locations, and with lack of computer literacy among staff which makes IT implementation even more of a challenge. Stand alone applications are not integrated either with other applications or with potential applications to be deployed in the future. Although the level of IT deployment varies significantly from one DISCO to another, the key applications have been in multilevel aggregation of data or large-scale data processing. In other words, IT is being used as a tool to address a specific issue or two at a time and not as a long-term, holistic strategy to achieve fundamental business goals.

HUMAN RESOURCES	QESCO's organizational culture is characterized with lifetime employment without substantial performance expectations, combined with poor compensation and remuneration. This environment makes it impossible for the company to recruit skilled human capital for open positions, because the best candidates demand higher salaries in private industry. The contemporary law and order situation in Balochistan have caused non-Balochi settlers to leave the province, creating a critical vacuum with respect to staffing for QESCO. As a consequence, there is a serious shortage of employees possessing the right mix of technical training, experience and motivation to accomplish the DISCO's mission. What is required is a complete assessment of the organization; to have the right number and quality of employees, and instill in them all the strategic message that quality of work, responsiveness to customer needs, and constant attention to safety are among the company's highest values. The RTC in Quetta has been one of the best training facilities visited by the PDIP, and deserves appreciation. However, there is an urgent need to reactivate the CTCs, as currently the RTC in Quetta is looking after training requirements for all the circles.
COMMUNICATIONS & OUTREACH	QESCO, like other DISCOs, still follows WAPDA's obsolete and tedious communications and outreach practices, involving much paper pushing. Traditional file culture is still in practice due to limited provision and use of computers. PEPCO carries out major mass media campaigns and QESCO's role is largely limited to piecemeal public relations activities, regarding company announcements, procurement and shut-down notices and messages for energy conservation. Customer satisfaction is hampered not just by poor service delivery, but also by untrained substitute staff working on an *ad-hoc* basis. Moreover, consumer culture is undeveloped in QESCO's service area due to consumers' lack of awareness, resulting in hostile and aggressive reception of shut downs. The utility needs to bridge this communication gap through a concerted public outreach program to restore consumer trust and confidence.

KEY RECOMMENDATIONS

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

GOVERNANCE	The Internal Audit Unit should report directly to the Board of Directors' Audit Committee. The Board of Directors should become QESCO'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. Name members to its advisory, executive, finance, and other committees. 4. Hire, monitor, evaluate, and fire the Chief Executive Officer and senior

	executives.
ORGANIZATION	A thorough review of organizational structure should be undertaken to evaluate organizational changes required to improve QESCO's technical, commercial and overall operational performance. Organization of the company 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 promises to improve many areas of engineering performance is to develop a GIS for the entire QESCO service territory; and link it with engineering software to develop long-term system planning capability. This would allow the utility to perform detailed short- and long-term work plans, identify loss reduction targets, and expand service capacity where and when necessary. Additionally, there is a need to look at a higher distribution voltage considering the vast rural network that QESCO serves, and currently feeders in excess of 300 km exist at the 11kV distribution voltage level.
FINANCIAL	QESCO's greatest financial vulnerability centers on its relationship with its government clients and the subsidy it receives from the government for the tubewell consumers. Given the unlikely prospect of significant progress in ensuring higher collection rates from this class of customer, the recommended solution is to negotiate tax payment offsets under which unpaid bills are discounted from collections of local and federal taxes. In addition, a new financial framework is needed within the organization and should include: 1. Updated accounting and internal audit procedures that more effectively serve the needs of the Board of Directors. 2. Initiation and completion of implementation of the ERP platform, and expansion of its applications to serve all finance and accounting needs in line with control, management, and financial reporting to the Board of Directors and to NEPRA and the Ministry of Water and Power as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization. 3. Improved transfers from external pay points to QESCO bank accounts. 4. Insurance coverage for buildings, equipment, inventories, and other assets as deemed necessary to eliminate exposure to significant financial loss.
COMMERCIAL	To improve the commercial management of QESCO, its commercial practices and procedures need to be updated, and implemented with discipline and integrity. Without carefully designed and integrated procedures, including a system of evaluation and monitoring, an effective and transparent system cannot evolve and financial viability will be at risk. The following recommendations, if implemented in a systematic and coordinated fashion, will result in increased revenue recovery, improved commercial efficiency, and enhanced consumer service:

	1. Consumer census to verify/add consumers. 2. Implement a metering program in conjunction with the Government of Balouchistan so that the tubewell consumers can be metered effectively and the metering is mutually accepted by both QESCO and the subsidy providers. 3. Develop communications and information technology infrastructure. 4. Reorganization of corporate structure so that all commercial units report to the Director Consumer Services. 5. Update metering, using advanced metering technology where appropriate (AMR), and evaluate use of meters on selected distribution transformers. The use of AMR on distribution transformers could be effectively used for the tubewell consumers. 6. Reorganize meter routes. 7. Implement energy accounting. 8. Design more comprehensive customer service and consumer awareness programs. 9. Enforce meter reading audits and meter inspection program. 10. Establish systematic meter repair, testing, and calibration 11. Effec recovery of receivables both for subsidy and energy usage and from the private customers especially from the agriculturae tubewell owners who not paying even the flat rate amount.
HUMAN RESOURCES	QESCO management should strive to create a conducive environment and employment conditions that enable all employees to: 1. Realize their responsibilities and possess the right skill sets to meet organizational goals and objectives. 2. Understand their uniqueness and contribution to the company's success. 3. Enjoy sufficient autonomy, authority and accountability. 4. Have access to proper equipment, support, knowledge and training to enable successful performance. 5. Be fairly compensated for the work they put in. 6. Be aware of their career path and of the company as their institutional home.
COMMUNICATIONS & OUTREACH	Like any other service delivery organization, QESCO requires a strong and well-positioned communications and outreach program. It is therefore recommended that it should: 1. Develop and implement a comprehensive communications and outreach strategy, especially with regards to its tubewell consumers to promote a better working relationship with this consumer category. 2. Strengthen the PR department, upgrading it into an integrated Communications and Outreach department with an enhanced decision making role and a regular budget to direct mass media, consumer advocacy and outreach campaigns. 3. Promote IT culture for fast and efficient communications. 4. Initiate implementation of Intranet and promote/encourage digitization and improved knowledge management. 5. Develop an annual calendar of outreach activities for consumer awareness and corporate brand building, integrating consumer outreach activities on issues of theft control, energy conservation,etc.

	6. Improve the Customer Service Department by creating a corporate outlook, providing consumer-centric and gender sensitive action plans, and training and development of staff skills. 7. Upgrade and maintain a strong web presence 8. Implement a monitoring and evaluation plan for staying abreast of changing communications needs. 9. Initiate awareness programs for consumer education and orientation regarding their responsibilities towards the company.

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 QESCO faces today, the report lays bare what is wrong and what should be considered by the utility's management to fix it. The obvious downside of trying to address this many problems is that the "wood may be lost for the trees." Several management approaches can help counter this.

Importance of a Strategic Plan

A strategic plan is the best way to manage complex change, overcome complacency, galvanize the organization and gradually alter course. Creating a strategic plan for QESCO, 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

QESCO 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 QESCO improving its operating performance and becoming financially self-sufficient. These 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 QESCO and overcoming them will be critical to success.

Appropriate Use of Technology

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

It is evident that automation technology can play a major role in helping QESCO 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. As noted earlier, employees are not accustomed to learning new systems and adapting their work flows to take full advantage of technology. Familiarity with computers, local area networks, and common desktop software is likely to be severely limited. Procedures that accompany technology-enabled business processes, e.g., backups, system modifications, to insure their robustness may be unfamiliar territory. *Accordingly, failure to allow sufficient time for rank and file employees to assimilate technology changes and participate in the redesign of their own business processes and work practices would put QESCO's technology investments at risk and technology projects could create problems rather than solve them.* In the near term therefore, emphasis should be on widely proven technology solutions that automate manual processes, especially in 'back-office' systems such as customer information and full build-out of ERP. More sophisticated uses of technology can come later.

Fostering a Corporate Culture that Embraces Change

Obviously, setting a course for the future does not necessarily insure that the destination will be reached, or reached safely. In QESCO'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 QESCO's employees to participate meaningfully in the fundamental changes that lie ahead will help spur the move to a new and higher performing corporate entity.

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

HOW THIS REPORT IS ORGANIZED

The main body of this report is organized in a way that is intended to highlight current challenges QESCO 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 QESCO 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

Overview

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

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

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

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 (NEPRA) was established, 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 HESCO 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.

Purpose of Operational Audit and Improvement Action Plan

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

QESCO Profile

Quetta Electric Supply Company (QESCO) is a wholly-owned government distribution company with headquarters located in the city of Quetta, capital of Balochistan Province. It is responsible for supply of electricity to the whole of the province except for the coastal district of Lasbela which is served by KESC. It has boundaries adjoining MEPCO and HESCO to the east and PESCO to the north. Its service territory is spread over about 334,616 sq. km.

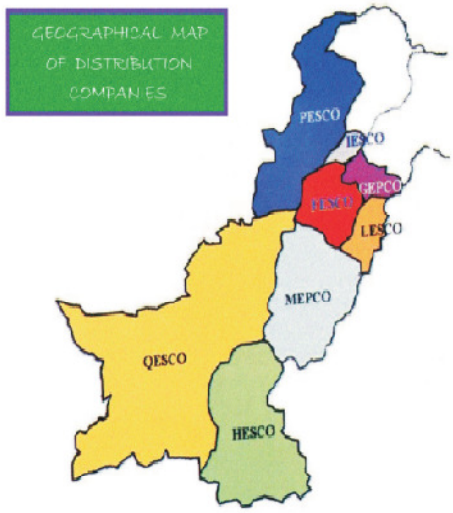


Fig. 1a: Location of DISCOs

Source: NEPRA Status of Industry Report 2009

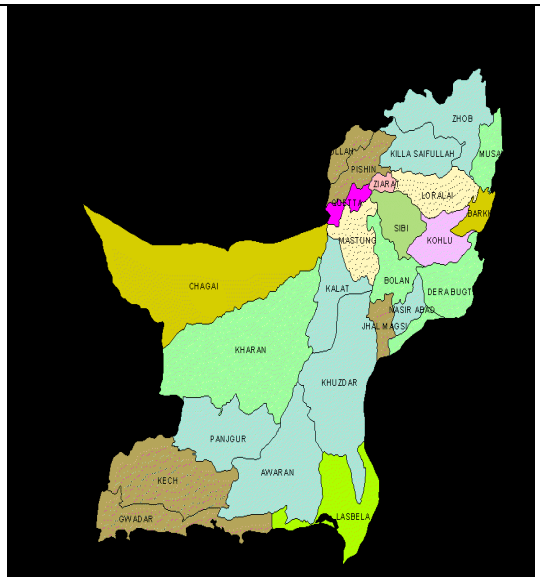


Fig. 1b: QESCO area map

QESCO has divided its area of responsibility into 3 circles, 11 divisions and 42 sub-divisions. In much of the its service territory, low voltage prevails due to long distances from generating sources and inadequate substation capacity. A single 220 KV line from Guddu is currently supplying QESCO while electricity is imported from Iran. Two additional 220 KV lines (Dadu-Khuzdar and DG Khan-Loralai) are expected to be completed by the end of 2011.

TABLE 1.1: QESCO CHARACTERISTICS

No	Description	Value
1	Administrative Districts Served	29
2	Service Area (km^2)	334,616
3.	Operation Circles	3
4	Operation Divisions	11
5	Operation Sub-divisions	42

General description of market

As of 30th June 2010, QESCO had approximately 76% of its customers classified as domestic. The other predominant category is commercial, comprising approx.19%. It was followed by agricultural/tubewell customers having a share of 4%. The industrial customers totaled less than one percent of all customers served.

TABLE 1.2: QESCO CUSTOMER DISTRIBUTION AS OF 30TH JUNE 2010

No.	Customer Class	Customers	Customer Mix %
1	Domestic	375,026	76.41
2	Commercial	91,264	18.59
3	Industrial	3,178	0.65
4	Bulk Supply	199	0.04
5	Tube wells	20,910	4.26
6	Other	228	0.05
	Total	**490,805**	**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. QESCO's primary clientele, unlike any other DISCO, is agricultural/tube-well consumers accounting for about 82% of sales. This is largely a result of the highly subsidized tariff for tube wells. Domestic consumers consume approximately 11% of commercialized power, while commercial and industrial consumers have about 2% and 3% share of sales respectively. Sale to bulk supply customers amounts to about 2%. Table 1.3 provides a summary of sales by consumer category.

TABLE 1.3: QESCO SALES FOR 2009-10

No.	Customer Class	Sales GWH	Proportion %
1.	Domestic	463	11.29%
2.	Commercial	93	2.27%
3.	Industrial	113	2.76%
4.	Bulk Supply	78	1.90%
5.	Tube wells	3348	81.68%
6.	Other	4	0.10%
	Total	**4,099**	**100.00%**

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

Statistical summary, comparison with other DISCOs

Some of the significant performance indicators for QESCO are shown in Table 1.4. QESCO has transmission distribution losses of 20.7%. The frequency and duration of outages is also quite high.

TABLE 1.4: QESCO 2010 KEY PERFORMANCE INDICATORS

No	Description	Value
1.	Transmission & Distribution Losses	20.7%
2.	Outages	
	Number of Outages	43,178
	Total Outage Time in Hours	57,404
	Hours per Outage	1.329

3.	Transformer Failure (% MVA)	2.5%

QESCO holds about 2.5% of the electricity distribution market in Pakistan in terms of number of customers but accounts for 6.4% of total energy sold in Pakistan while contributing only 3.5% to the total revenue collected. Its HT and LT network is only about 10% and 6% of the total length of HT and LT lines. The transformer capacity is 6% of the total. QESCO is responsible for about 8% of the sanctioned load and 7% of total non-coincident peak demand of all the DISCOs.

TABLE 1.5: QESCO FY 2010 STATISTICS

Description	All DISCOS*	QESCO	Share (%)
Customers	19,582,224	490,805	2.51
Sanctioned Load (MW)	47,855	3,999	8.36
Non-Coincident Peak Demand (MW)	19,288	1,316	6.82
Energy Sales (GWh)	63,660	4,099	6.44
Employees	122,530	7,095	5.79
Revenue (Million Rs)			
- Billed to Customers	488,022	24,044	4.93
- Collected from Customers	517,055	18,174	3.51
Receivables from Customers			
- Private	103,351	5,238	5.07
- Government	58,026	12,559	21.64
Total	161,377	17,797	11.03
Distribution Network			
- HT Line (km)	279,990	28,169	10.06
- LT Line (km)	205,020	12,169	5.94
- Dist Trans Capacity (MVA)	32,524	1,822	5.60

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

QESCO suffers from myriad problems. The long transmission lines are a major impediment in the reduction of losses. Legal as well as illegal tubewell connections are a significant drain on the system. Law and order issues pose significant challenges to effective business management ie. in retaining qualified staff, and create severe difficulties in disconnecting problem consumers. The utility accounts for 22% of government sector receivables for all DISCOs.

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

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 QESCO 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 QESCO 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

Governance

2.1.1 Overview

The PDIP team evaluated the structure and activities of the Board of Directors of QESCO to understand Board configuration and determine its board's level of authority. Key findings and analyses are presented herein. On November 22, 2010 all DISCO Boards were dissolved by order of MWP, so many of the PDIP observations presented here may not be entirely accurate. However in the interests of identifying potential improvement opportunities, findings of the review are given here nonetheless.

2.1.2 Summary of Key Findings

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

- QESCO's Board has not yet completely fulfilled its governance responsibilities, lacking the expertise and authority to meet challenges facing the company in the changing Pakistani power sector. Board powers are limited and it is unclear whether it has the ability to tackle major issues or oversee strategic change.
- The Internal Audit Unit reports to the CEO instead of to the Board's Audit Committee.
- Review of Board minutes indicates that matters considered are largely routine, and there is little evidence of strategic issues being taken up.
- Declaring its intention to reduce the influence of the government in DISCO governance and move these utilities towards greater operating independence, MWP recently dissolved the QESCO Board, appointing a new one in its place.
- Guidelines for the reconstitution of the new Board appear to provide a better mix of professionals and stakeholders.

2.1.3 Analysis & Discussion

The Board of Directors of each DISCO is governed by the Memorandum & Articles of Association, a document reflecting provisions described in the Companies Ordinance of 1984, as amended. The QESCO BOD consisted of seven members including the Chief Executive Officer. Because QESCO is wholly owned by the government, MWP has historically appointed 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.

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

The Memorandum and Articles of Association require two meetings each fiscal year, with other meetings held at the discretion of the Board. One of these 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 gear board members for the annual general meeting of shareholders and must take place within four months of fiscal year end. The Board has not yet developed any policies specific to the governance of an electric utility in general or to QESCO in particular, relying on the requirements of the Companies Ordinance 1984 and the Articles of Association of QESCO.

QESCO's Board has chosen to meet on a quarterly basis as required by the Code of Corporate Governance, although its rules are only applicable to listed companies in Pakistan. Review of Board minutes indicates that its powers are limited; matters considered are largely routine, pertaining to approvals of procurements and other mundane matters; and that there is little consideration of strategic issues or those germane to BOD consideration.

For example:

- The appointment and evaluation of the CEO's performance is perhaps the single most important BOD function in most corporations, but the CEO of QESCO is appointed by PEPCO and is a Member of the Board,
- Similarly, the entire senior executive cadre of the company is appointed by PEPCO rather than being selected or recruited.
- Board Members nominated from government agencies were senior in position and therefore in age, resulting in short board tenures and high turnovers.

In an effort to understand the powers the Board actually has, the Book of Financial Powers (BFP) was reviewed and discussed with the Secretary of the BOD, who is also Finance Director of QESCO. The BFP is a governing document and was approved by the BOD. It establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by QESCOs management and board in the operation of day-to-day activities. The company has prepared a draft of proposed changes to the Book to effect more efficient approval authorities and adjust monetary limits to reflect current financial climate. These proposed changes were made towards maintaining high corporate governance and internal control standards. It was the conclusion of the PDIP team that the QESCO BOD had relatively little authority over the management of the utility and could not be considered a true corporate board.

As mentioned earlier, MWP's notification of 22 November 2010 dissolved all DISCO, GENCO, and NTDC Boards of Directors. The order stated the intention to reconstitute these boards "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:

- Majority of Directors must come from the private sector.
- Ministers/Secretaries/Government officials may not be nominated as Chairmen of the BODs.
- Representation from the administrative Ministry/Division on the Board be restricted to one.

This is clearly an action intended to reduce the influence of Government in the governance of the DISCOs, and the notification should be considered a definitive step towards establishing these utilities as autonomous public corporations.

To serve the DISCOs in a professional manner, the new Directors will require training to strengthen their understanding of the role and function of independent boards of directors; as well as training to understand the commercial and technical nature of electric distribution utilities. PEPCO had previously been involved in BOD governance primarily as a manpower transition planning authority for the CEO and senior management. In addition it also acted as an authority on any proposed new positions at the DISCO. This was a role PEPCO assumed during a transition period after DISCO formation and never relinquished. The DISCOs must be able to manage their own manpower requirements.

The team noted that internal audit reports directly to the CEO instead of to the Board Audit Committee. PEPCO has sent instructions to all DISCOS in July 2010 to change this reporting hierarchy to the Board Audit Committee.

On 23rd December 2010 MWP reconstituted two boards, LESCO and PESCO. The LESCO board is now headed by the Chairman of All Pakistan Textile Mills Association (APTMA). Other board members include a professor from Lahore University of Management Sciences (LUMS), Ex-MD SSGC and SNGC, gas utilities, Joint Secretary Power of the Ministry of Water and Power, Ex-President Women Bank Limited, an Ex-Member Power (WAPDA), an EX-MD NESPAL and a development economist of international stature. The rest of the board members are persons representing important stakeholders. The new board appears to provide a better mix of professionals and stakeholders. However the BOD for QESCO has still not been finalised, and there has been no BOD for over 6 months now.

While the appointment of the Joint Secretary (Power) MWP as a board member does not violate the law nor the stated objective of limiting representation from the administrative ministry, it is nevertheless a step that does not encourage the stated goal of board autonomy and professionalism. The JS holds the line responsibility in MWP for supervision of the DISCOS, and his presence on the board simply reinforces the authority of the Ministry in all matters brought to the Board. Rather than a step in the direction of reconstituting the board along "professional lines", this is a step in the opposite direction, increasing government control.

Engineering Review and Analysis

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 analyses that resulted from this four-pronged engineering review.

Quetta Electric Supply Company Ltd. (QESCO) is a Public Limited Company incorporated in 1998 as an Electricity Distribution Company serving the entire Balochistan province covering almost 43% of Pakistan with only 4.5% of population density. QESCO is serving Baluchistan province with a total of 490,805 consumers and an average 3 % annual growth rate. Geographically, QESCO serves the remote, mountainous areas. It operates in 3 distribution circles, 11 divisions and 42 sub divisions with approximately 28,169 km of 11kV distribution line, 12,169 km of LT lines with 61 grid substations. Peak demand for FY2009-10 was 1,316 MW and purchases were 5,168 GWh, with an aggregate Transmission & Distribution loss of 20.71 %.

QESCO commercializes over 80% of its energy to agricultural customers against around 11.25 % to domestic customers through an 11 kV distribution network. It employs 33 kV as a distribution voltage for selected remote areas of its system.

Summary of Key Findings

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

- **Network—**QESCO's transmission network is seriously deficient and a source of significant problems for the company. The network cannot supply the full demand of the company, requiring QESCO to shed load even when there is no requirement for load shedding in the national grid.
- **Losses—**Transmission losses are stated to be 7.8%, and while this seems high, there is no question that the transmission network represents a serious source of loss for the company. Losses are due to a combination of long lines, the use of low transmission voltages such as 66kV and 33kV and poor overall control of reactive power demand.

Distribution System Management: PDIP's 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 QESCO for use. This type of load forecast is widely recognized in the industry to have very low utility as it cannot reflect changing conditions or economic conditions. Moreover, five years is widely considered to be too short a timeframe for a load forecast given long lead-times needed for distribution facility planning and construction. The PDIP team found no evidence that the data needed to prepare a more acceptable end-use or econometric forecast were being collected.
- **Feeder mapping**— Feeder mapping is not carried out on a systematic basis. Each subdivision has its own single line diagram of feeders, but no geographic maps exist anywhere in the company. The Planning Department sends its surveyor to track the feeder, using the odometer on his motorcycle and other estimating means to assess length as and when need arises. The resulting track, along with conductor and transformer size information, is hand drawn on taped together pieces of paper. Distribution circuits are hand plotted on paper copies of Survey of Pakistan quadrangle maps to perform area planning manually. Feeder bifurcations or connections from newly commissioned grid stations are generally decided this way.
- **Feeder analysis software—**The software used by QESCO for feeder analysis is obsolete and lacks many standard contemporary distribution analysis software features, 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 QESCO.
- **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—As noted earlier, c**onstruction and maintenance work practices prevalent among QESCO employees are inconsistent, ad-hoc and inhibited by limited equipment/ transportation. The consequences of these failures are profound—routinely jeopardized employee safety; low worker productivity ; exceedingly slow response to customer requests ; and extremely frequent equipment failures . All have negative financial impacts for QESCO.

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

- **Procurement**—QESCO conducts a large number of procurements annually, often for relatively small dollar amounts. Also, procurement practices that are non-standard effectively preclude international companies from bidding, unnecessarily narrowing the competitive field and obviating potential savings.

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

- Detailed modeling of distribution system losses indicates that technical losses on QESCO's system should be approximately 10.5% of annual energy (kWh), which is well above the benchmark comparison. High levels of loss are due to long lines and small conductors at the feeder departure from the substation. Poor power factor is also likely a problem, although it was not possible to actually measure feeder power factor.

- QESCO reported actual distribution system losses of 14.2% in the 2009-10 fiscal year. The difference between the distribution technical loss of 10.5 % and the total distribution loss 14.2% is a non-technical loss of 3.7%.

- Although the calculated non-technical loss is not excessive, observation of the system indicates that it is probably not realistic. Meter tampering and illegal line taps were observed during the inspection. Since much of the agricultural load is served at a fixed rate, it is possible the estimated consumption on these consumers is high, thus covering up the non-technical loss in the rest of the system.

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 Quetta, the only focus was on replacing HT conductor with higher capacity and bifurcation of feeders. No activity is underway to evaluate other changes required in standards for this purpose.

Analysis & Discussion

The QESCO transmission system comprises many elements, with the principal service being a 220kV network serving Quetta City. This is supplemented by eight additional independent transmission delivery points from neighboring utilities, including three from Iran. The main 220kV system is heavily loaded, as evidenced by the fact that QESCO must shed load to maintain voltages at an acceptable level in Quetta, even if no load shedding is called for by the national grid. Local Quetta area generation is called upon to provide up to 120MVAR of reactive power support to the 220kV transmission network, and even this is not enough to prevent load shedding during high load periods. Losses in the network are

stated to be 7.8%, which is high for a transmission network. System peak demand is 1,338 MW, a figure that is somewhat suppressed by load shedding

The engineering assessment of QESCO consisted of three components. The first is an evaluation of transmission issues. The transmission system at this DISCO was seen as a potential source of problem in addition to the distribution system, having about 7.5 % of transmission & transformation losses as stated by QESCO for the year 2009-10, which is very high.

The second component is an evaluation of distribution system management resulting from a series of interviews with staff from the Planning and Design, Construction, Operations, and Procurement Departments. During these interviews QESCO staff responded to the team's questions and provided insight into the technical operations of the utility. These accounts are inevitably colored by the attitudes of the interviewees, as well as the misunderstandings of the interviewers, and should be taken as indicative rather than absolute truth.

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

Transmission System Assessment

QESCO has a transmission network of 774km of 220kV, 3,994km of 132kV, 636km of 66kV and 945km of 33kV lines totaling 6,239 km, receiving power from NTDC through six (6) interconnects and about 39 MW from Iran through three (3) interconnects at Jawa (2 MW), Jalaq(2MW) and Jackigor (35 MW). There are 61 grid substations under QESCO, 51 of which are energized at 132kV and 10 of which are energized at 66kV. System peak demand is 1,338 MW, a figure that is somewhat suppressed by load shedding. The principle feed to the load center at Quetta City is via a long 220kV system originating at Guddu power station. This system is unable to maintain voltage during system peaks and as earlier noted QESCO must shed load to maintain local voltage whether or not such shedding is required by the national grid. Local Quetta area generation provides up to 120MVAR of reactive power support to the system on peak, but even so, it is necessary to shed 200MW of load in order to maintain system voltage.

Transmission losses are stated to be 7.8% which is very high. QESCO does not have a dedicated Project Management Unit like other DISCOs, responsible for transmission and grid station network planning and operation. However, this activity is being looked after by Chief Engineer Grid Station Operation (GSO) and PD construction GSC who report to the General Manager Technical. Secondary Transmission & Grid Station (STG) projects are prepared in consultation with NTDC.

Total system losses in QESCO during FY2009-10 were 20.71% as reported to NEPRA. A review of the data provided to the team on 11kV feeders indicates that distribution loss was 14.2%, leaving 6.5% for transmission loss against 7.5% as presented in PEPCO's report. A preliminary estimate of transmission losses using estimated values and a simple model of the system yields a likely transmission loss of 6.7%, including loss in grid substation transformers. There is compelling evidence for transmission issues contributing negatively to the financial performance of QESCO. The cause of the high transmission losses are long lines, and the continuing use of significant 66kV and 33kV transmission in the QESCO system. The company has been able to convert a number of 66kV grid stations to 132 kV under 6th STG

program and are in the process of converting the remaining ones under 7th STG plan and Kuwait Fund program. Nonetheless, a simple model of the system with only 132kV lines predicts 6.7% loss, so this remains an issue. Due to time constraints it was not possible to carry out detailed modeling of the transmission network, but the most likely opportunity for reduction in transmission losses is control of reactive power. This will require not only the control of load power factor, although this is a very important component, but also the development of a reactive power control plan which incorporates transmission level capacitor banks and reactors so that losses due to reactive power flows can be minimized.

Distribution System Management Assessment

Planning and Design

Planning and design of distribution lines are carried out in the same department, headed by 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 QESCO cannot be described as adequate. At present there is no Chief Engineer Planning & Engineering and the department is headed by the Director Planning who is due to be retire in a few weeks. 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 16 work orders were issued for HT rehabilitation / bifurcation under the ELR program; whereas 160 job orders were issued for LT network including augmentation of distribution transformers or addition of new LT networks. Comments on the various components of utility planning are as follows:

Load Forecasting

A five year load forecast is routinely prepared, however the determination of growth rates that should be employed for each customer class is made by NTDC and communicated to the DISCO. QESCO (and other DISCOs) are not expected to collect data for the purpose of estimating load forecasts, population growth, demographics or sales. Data for sales by consumer class is supplied to NTDC, but the process is prescriptive once the growth factors have been received; QESCO 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 determines the Growth Factor to be used by the 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 have not been developed and are hence unavailable. When a feeder enters into an overload situation, defined as exceeding a peak load of 300 amps;, or the operating subdivision suspects a distribution transformer is overloaded, it advises the Planning Department. The Department sends a 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 Ddpartment is resolved, the project is archived and no effort is made to maintain or update the feeder information.

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

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

System Analysis

The software used for distribution feeder analysis is called Feeder Analysis (shortened to FDRANA), and was developed during the 1980's under a USAID Power Distribution program. It operates in MS-DOS and is capable of analysis of a single feeder and its branches, producing a tabular output that assesses voltage drop and 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 obsolete and lacking many standard contemporary distribution analysis software features, 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, inhibiting the incentive to do alternative evaluations. Furthermore, the software's limitations make it difficult to do multi-feeder area planning and exploration of system alternatives, which could result in sound distribution expansion, operation and maintenance. Additionally, though this program has the capability to determine distribution transformer losses connected on the feeder, this facility is not being utilised as the operators do not have access to the transformer specifications and are unaware 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 on reconductoring or bifurcation of the feeders.

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 QESCO, many customers have paid for installation of dedicated transformers ranging in size from 25 to 630 kVA. In the vast majority of cases these dedicated transformers are installed in the same fashion as the public use transformers, i.e. on overhead platforms.

The only significant alterations in these standards since they were established have been the introduction of concrete poles. Prestressed reinforced concrete poles were initially approved, but design is moving toward centrifuged poles due to their higher strength and the resulting ability to carry three circuits. An additional change has been the adoption in the 1980's of the Osprey (556MCM 18/1) conductor for 11kV circuits with heavy electrical loading. Osprey has a current carrying capacity of 700 amps (13MVA) so should provide considerable capacity. In actuality, the majority of QESCO's switchgear is limited to 400 amps per phase by the current transformers in the breakers, hence the need to consider circuit adjustment at 300amps. This limitation severely limits the usefulness of the Osprey conductor.

Construction
The mission of the Project Department at QESCO is, as stated by the Project Director Construction, preparation of feasibility reports for ELR, DOP and village electrifications. He emphasized that the Department does neither design nor procurement but is responsible for getting the projects constructed through local prequalified contractors in QESCO. However, proposals are prepared for village electrifications after performing physical surveys of the areas sponsored under MNA & MPA funds. The projects undertaken by this department fall into three categories:

- Projects funded from QESCO's budget for distribution upgrading and energy loss reduction.
- Village Electrification Projects implemented through MNA/MPAs funds.
- Deposit work paid for by others; such as line relocation required by road widening, for customers seeking independent feeders, or for the housing societies.

There is no Village Electrification Master Plan, so the annual budget does not contain any expenditure for this purpose. Rather, a member of the National/Provincial Assembly identifies an area he/she wants electrified, and obtains funding from the national/local government for the project according to their influence with the party/government in power.. According to the rules governing these sorts of projects, QESCO can budget a village electrification project only those amounts required for the actual line extension. There is no planning study to determine what effects the proposed extension will have on the backbone system, or even whether voltage service will be adequate once the service is constructed. These problems are all left for QESCO to correct or accommodate during the operational phase.

For village electrification, the Project Department examines the locale of the project and prepares a 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 causes delay in construction.

The Project Department supervises all construction activities carried out by the local contractors for all projects through its own work force. Each responsible sub-divisional officer, and line superintendent is supposed to inspect all construction, with higher level officers required to inspect declining amounts of the work.

A field inspection of the QESCO 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 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 level, was used to pressure the reassignment of linemen from the construction to operations.

Operations and Maintenance

The fundamental organizational unit for operations at QESCO is the subdivision, of which there are 42 in the company, each serving approximately 11,700 consumers. Operations subdivisions are defined geographically by feeder service areas and are grouped into divisions with approximately three to four subdivisions per division with 11 operations divisions. Divisions are grouped into circles with approximately three to four divisions per circle. QESCO has three 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.

Due to security constraints, PDIP's engineering team was restricted to the immediate environment of QESCO headquarters. Even in Quetta City, the team was unable to visit circle or divisional offices. However, it visited Quetta Cantonment Subdivision, accompanied by Chief Engineer Operations and the concerned Superintendent Engineer (SE) to understand how the area is managed. Cantt. Subdivision serves around 16,400 customers comprised of 11,271 domestic, 4,694 commercial, and 77 industrial customers out which 13,000 are active. This particular subdivision manages its customers through five general 11kV feeders with 381 distribution transformers of various capacities, 159.2 km of HT and 281 km of LT lines. The subdivision also manages seven independent feeders for industrial and government consumers. Some of these feeders have reported losses that are greater than 25 %, whereas the collective progressive losses for the subdivision are 13.9% which is still very high for predominantly an urban subdivision. This high loss figure was attributed to old deteriorating meters, lengthy LT lines, and service drops especially in the congested areas of the city with exposed LT tempting illegal tapping i.e. "kunda connections". The Superintending Engineer 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 principal activities of subdivision staff are as follows:

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

Each subdivision typically has approximately 70 staff, of whom roughly 60% are assistant linemen, linemen, or line supervisors; 15% are meter readers and bill delivery staff; 5-10% are complaint center staff; and the remainder are managers or other support staff. It was stated that only about half 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. The centers receive complaints either in person or by telephone, and record these in rough form on notepaper, transferring the information later to a ledger. However in certain cases especially in far flung areas complaints of burnt LT jumpers are attended to by local non utility staff The complaint register was examined and it was found that most complaints are of high and low voltage jumpers, loose or excessively sagging bare conductors posing a threat to the general public.

In addition to the hand tools, the complaint center had some larger tools, including a grounding set, fiberglass ladders and various switch sticks and tree trimming hooks. The grounding sets were of a design that simply hangs on the conductor rather than being clamped to it, and would not be considered adequate for personnel protection. The grounding set inspected had failed at the joint between the three leads and been repaired by wrapping the joint with aluminum wire. The ladders were fiberglass, of high quality and in relatively good condition. The switch sticks were generally made with bamboo handles or with pieced together fiberglass handles. Neither type of handle had a surface finish that would be considered adequate for use on high voltage lines. All the switch sticks and ladders were stored in ways and places that exposed them to damage from other items lying against them. The 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 whatever. The subdivision building was very cramped and in poor condition, and the stores area full mainly of junk such as broken insulators, recovered wire and hardware, etc. No doubt some of these items were to be reused to restore service, but there was little new material to be seen.

The PDIP 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, apparently because the connections tend to loosen with thermal cycles and must be periodically retightened. Of course, leaving the connections uncovered makes the meter vulnerable to the most basic forms of tampering.

The installation and 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.

In addition, the installations of bare conductor distribution lines close to buildings are prone to illegal taps commonly known as "kundas". An example of crowded LT services connections and typical "kunda" connections are shown in the pictures below:

The subdivision had one or two light vehicles for general transportation, out of which one is reserved for the use of the Sub Divisional Officer (SDO) and the second left for maintenance use. It was stated 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 a problem is reported.

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

The engineering team observes that issues affecting lineman safety in electric utilities are not unique to QESCO 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 QESCO 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 QESCO 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 QESCO staff but needs further examination.
- Poor work planning procedures that do not consider safety a goal of the project.
- Failure to maintain an environment in which safety is emphasized on a daily basis as part of the work schedule.
- Lack of sanctions for staff that knowingly 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

QESCO 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 the company 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 exposed to other hazards. A problem common to both new and old meters is the unauthorized access to meter bottom connections, a perennial risk with A-base meters.

QESCO's generally high level of losses indicates that these vulnerabilities are amongst its major issues, and observation indicated that most meters were poorly installed. Bottom connections on the meters were not covered or sealed, , and the DISCO does not have a meter calibration 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 QESCO.

Procurement

Procurement is carried out by the Procurement Department. This 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 among 29 categories according to a legacy WAPDA classification list, although in reality only approximately 19 categories are commonly used. However each category has sub-classifications which may be separately procured, and solicitations for any given subclass are held twice a year, resulting in a large number. 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 QESCO is responsible for management of the two (2) central warehouses at Sheikh Manda (Quetta) and Sibbi as well as for procurement, but materials pass from the direct control of this 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. During fiscal year 2009-2010 QESCO procured material worth Rs. 1.6 billion, and is planning to enhance procurement to the tune of Pak Rs. 2.00 billion in 2010-2011.

Distribution Feeder Mapping and Loss Segregation Analysis

As discussed in the Methodology section, the segregation of technical and non –technical losses for the QESCO distribution system is based on power flow models of a sample of QESCO feeders. The process calls for selection of feeders on the basis of a consistent sampling method; mapping the feeders using a simplified geographic information system (GIS) tool, collection of feeder peak load, and power factor data from substation feeder metering; and modeling of the feeders using power flow software.

The intent of the exercise is that the technical losses will be used as a 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. Furthermore, the power flow model will allow segregation of technical loss between 11kV lines, distribution transformers, LT networks and service drops.

Selection of Feeders

According to data provided during its annual business plan presentation in October 2010, QESCO has 431 11kV feeders with a total of 37,563 km of line. Average feeder length is approximately 87 km. There are however many feeders both considerably longer and shorter than this value, with different combinations of consumer load types. Clearly, in order to select a sample of feeders that is representative of the utility feeder population as a whole, it would 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 QESCO 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 QESCO on the entire feeder database. Because the utility'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. QESCO feeder classification as to whether they are urban (U), rural (R), industrial (I), or dedicated (D) to a single consumer was not available. Issues with the data provided are summarized below:

- QESCO provided data on a total of 431 feeders, however 4 of these had sales of zero for FY2010. This means there are a total 427 active feeders.
- A total of 58 feeders showed negative losses, out of which 3 showed a negative loss of more than 150 % to 200 %.
- A total of 131 feeders are having losses of more than 20 %, out of which 71 are showing losses between 20 to 30 %, and 60 are showing losses between 30 to 100 %.

The anomalies in the data appear to be due to the 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, 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 Feeders characteristics.

Feeder Name	Length	Demand	Sales MWH				
	km	Amps	Domestic	Commercial	Industrial	Tube Well	Other
Chashma	60.5	199	810	49	172	11,580	1
Nausar	46.3	179	283	217	80	9,872	0
Umer	39.6	299	4,666	360	183	11,232	2
Bostan	32.1	154	448	34	86	6,204	0
Faizabad	45.2	309	261	2	1	7,908	0
Sample Average	44.6		11.9%	1.2%	1.0%	85.9%	0.0%
QUESCO Average	**87.0**		**11.3%**	**2.2%**	**2.8%**	**83.7%**	**0.1%**

Table 2.1 shows the sales breakdown for the sample of feeders chosen for mapping. The length of the feeders chosen for mapping averages 44.6 km, compared with an average length of 87 km 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 the PDIP team was restricted to remaining in Quetta circle owing to 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. This is a standard distribution analysis software used widely in the US and Latin America. It 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 QESCO 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 were obtained from tables and incorporated into the database. Similarly, QESCO 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 QESCO transformer values of no-load and load losses, as shown Table 2.2 below:

Table 2.2 QESCO transformer characteristics.

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

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

higher than those indicated. Also, a significant number of transformers have been repaired, often under informal conditions, with uncertain effects on the level of losses.

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 11kV 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 was carried out. Table 2.3 below shows the results, disaggregated by line (conductor) loss, and transformer no load and load loss.

Table 2.3 Results of load flow analysis.

Feeder Name	Length km	Peak Demand kW	Line Loss kW	Transformer Loss	
				No-Load kW	Load Loss kW
Chashma	60.54	3,030	155.4	22.9	47.8
Nausar	46.32	2,732	375.2	21.0	41.3
Umer	39.58	4,553	509.0	36.1	62.8
Bostan	32.14	2,804	409.5	12.9	78.4
Faizabad	45.16	4,710	1313.4	18.2	155.6

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 eight (8) LT networks was mapped and modeled. The process of mapping differed from that used for the 11kV feeders in that for the LT networks, the mapping included a consumer census of all the consumers fed by the network. In addition, a meter reader accompanied the survey team, carrying with him the meter read route book from June 2010, the month of assumed peak demand. It was therefore possible to obtain and record in the GIS database for the LT network the metered consumption for each consumer.

Since the majority of the consumers located on the LT networks are billed by kWh consumption only, it was necessary to convert the kWh data to demand (kW) for modeling. As no measurements of actual demand were available, it was necessary to estimate demand using only the average energy consumption

of the consumers. In order to determine the peak demand in kW likely from consumers on each LT network during the month of June, the data on consumption was applied to the demand equation below. This equation was derived many years ago by the Rural Electrification Administration (REA) in the United States, and has been verified by NRECA as acceptably accurate for use in developing countries as well. The equation is as follows:

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

Where:

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

The demand value calculated by the equation was applied as the source demand for the particular LT network, at the power factor of resulting from the HT model, and the demand allocated to the segments of the LT network in proportion to the kWh of the consumers connected to that segment. The result is shown in Table 2.4 below:

Table 2.4 Modeled LT losses.

Model Feeder	Length (km)	Transformer Size kVA	LT Source Load kW	Source % p.f.	Total Loss		
					kW	% Loss	W/kVA
Sheikh_Maanda_Chas_SC1	0.42	100	20	81	0.124	0.62%	1.24
Sheikh_Maanda_Chas_SC2	1.48	100	21	81	0.269	1.28%	2.69
Sheikh_Maanda_Nausar_SC1	0.46	100	7	83.6	0.012	0.17%	0.12
Sheikh_Maanda_Nausar_SC2	0.53	100	8	83.6	0.064	0.80%	0.64
Khanewal_Mehar_Shah_SC1	1.70	200	97	82	2.87	2.96%	14.35
Khanewal_Mehar_Shah_SC2	0.78	200	27	82	0.305	1.13%	1.525
Yaru_Bostan_SC1	1.07	100	11	83.8	0.039	0.35%	0.39
Yaru_Faizabad_SC1	1.36	100	12	91	0.105	0.88%	1.05
				Total Average Loss LT		1.02 %	3.8

The results of the LT analysis show that LT losses vary from 0.17% to 2.96% of the power delivered by the transformer. Average loss for the LT network is 1.02%. The lengths LT networks were in the order of 1000 meters per transformer, although one of those sampled was only 420 meters. Loading for this group of transformers indicates that only a relatively few number of QESCO's transformers are likely to be overloaded, especially in the urban areas.

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 3.8 watts per kVA of general use transformer capacity was developed. As can be seen, there is considerable variation in the value of this parameter from one transformer sector to another for the urban transformers, and 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 2.5 below indicates the assumptions for the three types of consumer.

TABLE 2.5. CONSUMER SERVICE PARAMETERS.

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 QESCO 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 QESCO 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 2.6 as follows:

Table 2.6. Summary of modeled losses in QESCO.

TABLE 2.7 RESULTS OFPRELIMINARY LOSS ANALYSIS BASED ON A SAMPLE OF FOUR FEEDERS					
Feeder Type	**Conductor Loss %**	**Transformer Loss %**	**LT Network Loss %**	**Service Drop Loss %**	**Annual Energy Loss %**
Total Sample	7.45%	2.7%	0.2%	0.2%	10.5%

As noted above, QESCO had actual distribution system losses of 14.2% in the 2009-10 fiscal year. The difference between the distribution technical losses of 10.6% and the total distribution loss 14.2% is a non-technical loss of 3.7%.

Validation

In its report to MWP of October 2010 QESCO reported technical losses of 13.9%, and 7.8% transmission and transformation losses. Its management later presented T&D losses of 20.1% in different presentations to the PDIP team. Thus it was decided to carry out an independent evaluation using a benchmarking technique developed for electric systems in the rural US. Studies conducted by the Rural Utilities Service, the financing and monitoring arm of the US rural electric program, have determined that for systems using conductors and voltages typical of good engineering practice, distribution system loss is a complex function mainly of sales density, that is MWh sales per km of line. The equation developed based upon that parameter is as follows:

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

Where:

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

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

Applying this equation to the Pakistan DISCOS results in Table 2.7 below:

Table 2.7 Benchmarked losses from RUS parametric analysis.

HESCO BENCHMARKED LOSSES			
HT & LT Km	Sales Density MWh/Km	Benchmark Technical Loss %	Actual Distribution Loss %
63,831	64.2	8.4%	14.2%

It is apparent that according to this benchmark, QESCO should have a distribution loss of approximately 8.4%, a value which is considerably less that that either experienced by QESCO or estimated by the PDIP team's model. This indicates that the utility's opportunities for loss reduction are mainly in the area of technical losses, although there is also potential for reduction of non-technical loss. A particular factor in QESCO is that agricultural consumers normally pay a flat monthly rate, with a portion of the consumption subsidized by the government. Due to inoperative meters, much of this consumption is estimated, and it is thus possible that agricultural consumption is overestimated, which would tend to reduce the apparent non-technical losses.

Possible Technical Opportunities for Reduction of Non-technical Loss

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

- Mapping of lines and consumers using a GIS provides important information for use not only in planning, but also in monitoring of transformer loading. Accurate location of consumers, with respect to the feeder and transformer that serves them, allows for better tracking of feeder losses and can aid in identifying areas where theft is high, as well as provide a means for evaluating the impact of other improvements.
- Open conductor LT line is notoriously vulnerable to unauthorized hooking or "kunda" connections. Replacement of at least some of the open LT system with covered multiplex conductor would assist in limiting loss from this source.
- The engineering team was advised that approximately 95% of QESCO meters are still of the old electromechanical type, and these are notorious for slowing as they age and for vulnerability to tampering. While wholesale replacement of these meters with electronic units may be more expensive an activity than QESCO wishes to undertake at the present time, a campaign for calibration of the existing meters would have immediate results at a 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
- Low power factor has been shown to be a serious problem for the QESCO transmission network, and can be assumed to constitute a problem for the distribution system as well. It will be necessary to carry out a more detailed study of distribution consumer power factor in general, and reactive power control on the transmission network in particular.

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

Financial Audit and Analysis

Overview

The financial management Operational Audit was designed to evaluate the effectiveness and efficiency of financial management for QESCO. 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 and procedures.

Summary of Key Findings

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

Cash Receipts and Disbursements

- QESCO's collection rate for government clients – 60.8% - is much lower than it is for private clients – 77%. GOP accounting regulations prohibit making provision for past due receivables from government clients, and therefore the company must consider all government receivables as collectible.
- QESCO 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 etween billed and collected taxes is paid from company's distribution margin. These taxes represent a significant financial burden.

Financing and Investments

- Though QESCO has revenues of Rs. 42 billion ($US 504 million) per year, it could only afford to undertake about $39 million of system investment 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 unit'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.
- The Internal Audit Dept. reports directly to the CEO, with no direct reporting relationship to the BOD.
- There is concern with the lack of training and professional competence within the Internal Audit unit.
- There was significant inefficiency in materials inventory management. The ratio of materials used to the average inventory balance is .93 as compared to over 2.0 for the average of all other DISCOs.

Cost Containment QESCO's vehicle fleet consists of a total of 471 vehicles; 144 of which are 20 old or older. The company's fleet management policy requires vehicle replacement after ten years, but this rarely occurs on schedule due to conflicting approval policies. Even if QESCO were to demonstrate that

purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy allowing for vehicle replacement. Not surprisingly, older vehicle maintenance costs are significant.

- QESCO has significant financial vulnerability owing to lack of insurance on its facilities. Grid stations and certain new vehicles are presently the only facilities covered.
- QESCO is currently paying PEPCO approximately Rs 2.5 million per year as a software license fee for three applications (billing, payroll and inventories). This expense would be eliminated and may help fund the migration to ERP.

Financial Reporting

- The current accounting system is unable to meet the growing needs of QESCO,which is an entity comprising geographically disbursed cost/revenue centers. There is extreme complexity in the number and type of transactions and data flowing between the various regions and headquarters. In addition, there are numerous offices requiring an integrated information system solution. The ERP solution is currently being evaluated.
- The most recent independent auditor's report was qualified due to the inability of the auditors to verify the value of the plant stated on the financial statements.
- QESCO continues to use a legacy WAPDA accounting manual that has become increasingly outdated due to changes in accounting practices in Pakistan. The QESCO Finance Director is in the process of updating this manual.

Financial Performance

- The current ratio is an indication of an entity's current ability to pay its debts. Generally, a ratio below 1.0 means it may have trouble meeting these obligations. QESCO's current ratio of .57 needs periodic monitoring should its financial position worsen.
- Maintenance expense as a percentage of operating revenue indicates that QESCO is spending significantly less – 1.7% - than are the US rural electric cooperatives – 7.98% - to maintain its electric system. However this is partly explained by the fact that QESCO has invested a significantly smaller amount in total utility plant per kilometer of line than have the US cooperatives.
- The plant revenue ratio (total utility plant/operating revenue less cost of power) indicates QESCO has more operating revenue remaining after power costs to support its existing plant through operations and maintenance expense – 4.0, when compared to the US cooperatives - 6.3. A smaller plant revenue ratio indicates higher revenue per unit of investments in the plant. The US coops have invested significantly more in total plant per kilometer of line – Rs. 2,622,327; than has QESCO -,Rs. 598,164. The amount of trade debt receivables over 60 days as a percentage of operating revenue is significantly higher for QESCO – 12.6%, than for the US cooperatives – 0.23%. This comparison is based upon FY 2010 QESCO trade debt.
- The US rural electric cooperatives' consumer density averages 8 consumers per kilometer, while QESCO has 13 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while QESCO's consumer to employee ratio is 73 to 1. QESCO is significantly below the average in consumers per employee when compared to other DISCOs (see Table 2.9 below). It could enhance its financial position significantly by improving its consumer to employee ratio. Were QESCO able to achieve a consumer to employee ratio close to 467:1, the savings would approach Rs. 1.25 billion per year.

Analysis & Discussion

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

Cash Receipts and Disbursements

QESCO 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 QESCO central bank account. The utility receives 55% of its deposits the same day in its bank account; and 30% of deposits, primarily from offline banking, are received within two to three days after payments have been made. The remaining 15% of deposits, received from post offices, take up to a week to be transferred to the QESCO primary bank account. The DISCO then makes daily payments from central bank accounts to PEPCO/CPPA after deducting pre-authorized expenditures against distribution margin. Significant improvements can be made to improve cash transfers to the QESCO account on a timely basis.

The external auditors have reported the following observations in their covering letter addressed to the BOD on the Financial Statements for the year ended June 30, 2010; "During our review, we noted un-identified cash listing amounting to Rs.48.946 million at various divisions, mainly due to difference in reference numbers of customer file and master billing file, and also due to missing stubs from banks. As a result debtors are updated in the master file but not in the subsidiary ledger. This ledger is updated when a customer lodges a complaint and the company receives proper evidence of payment from a specific customer. We suggest the company should monitor the balance of unidentified cash listing and take steps to update the subsidiary ledger on 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.

QESCO annual reports show significant trade debt receivables. The company makes provision for doubtful trade debt accounts using the policy outlined in Table 2.8 below:

Table 2.8 Trade debt provisions for delinquent consumers

No	Category	Value (%)
1.	Disconnected consumers over 1 year	100%
2.	Consumer receivables 3 to 12 months overdue	10%
3.	Consumer receivables 1 to 3 years overdue	65%
4.	Consumer receivables over 3 years overdue	100%

In fiscal years 2009 and 2010, a provision was recorded as an expense in the amount of Rs. 1,023,217,781 and Rs. 672,292,450 respectively. In fiscal years 2009 and 2010, the trade debts written off were Rs. 1,001,436 and Rs. 325,621 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 this 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, QESCO was higher at 12.6% than the US rural electric cooperatives at 0.23%.

Following the policies illustrated in Table 2.8, QESCO accumulates provisions for past due accounts receivables under the observation that these are uncollectable. The cumulative total provisions at the utility amount to Rs. 3,984,173,710. Given that QESCO considers these accounts uncollectable, it makes no further attempt to collect them. The company could consider engaging a collection agency to make further attempts vis a vis these accounts, paying a percentage of the collected total towards achieving the targets, paid on a contingency basis.

The QESCO collection rate for private clients – 77% - is better than for government clients – 60.8%. These collection rates have drastically reduced to 21% in the first six months of the current financial year as the Govt. has withdrawn the agricultural subsidy on tubewells.

GOP has extended subsidy to agricultural consumers of Balochistan. Accordingly they are billed at notified tariff rates but continue to be charged upto a maximum of Rs. 4,000 per month per connection. The remaining amount is to be borne in the ratio of 40:30:30 by GOP, the Government of Balochistan and QESCO, respectively. QESCO's share of subsidy has been allowed as an expense by NEPRA while determining the tariff. The agricultural subsidy disbursement by both Federal & Provincial Governments is done in a timely manner. The total receivable on account of agricultural subsidy is Rs. 6,824 million FYE 2010, Rs. 2,578 million from GOP and the remaining amount from the Govt. of Balochistan.

QESCO and 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 as receipts against billings. The following describes amounts collected monthly in addition to the consumer electric bill:

- General sales tax (GST), assessed at 17% on domestic consumers and export industries.
- Income withholding tax: 5% and 10% retained at for industrial and commercial consumers respectively.
- Excise duty of 1.5% on all consumers (varies by local jurisdiction).
- A flat fee of Rs. 35 on domestic consumers to support the national television network.

- Surcharges may be assessed as needed to cover the costs of certain power plant projects

Given that GST is levied on the basis of billings, the DISCO is forced to remit payments for this tax on all billings, regardless of whether the bills are actually collected. Thus, even though taxes are considered a pass-through, the difference between billed and collected 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. 1,199,125,891 in FY 2010.

The company owes CPPA against the Power Purchase Price of Rs. 68,959,839,836 and Rs. 51,168,320,361 for FYE 2010 and FYE 2009, respectively. The main reason for this massive payable can be attributed to the substantial amount of receivable from GOP against tariff differential subsidy, tubewell subsidy receivable both from GOP and GOB, trade receivables, inadequate tariff approved by NEPRA and large amount of accumulated loss.

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 undertake system improvements when prudent and necessary. QESCO's financing needs are only met through long term financing arranged through the government. This financing may be typified as Kuwait Fund and Asian Development Bank lending, but in reality these funds are actually lent by the donor to the Government of Pakistan, who on-lends them to the DISCO. Subject as they are to the geopolitics of government and multilateral bank relations, such financing is not related to the financial strength or particular needs of the utility, is always project specific, and cannot be relied upon to be available when needed by the DISCO.

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 not always aligned with the utility's individual financial sustainability. QESCO'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 QESCO essentially an operations oriented entity. One of the reasons that system planning is so constrained is the shortage and uncertain availability of significant investment funds. Though the company has revenues of Rs. 42 billion ($US 504 million) per year, it could only reliably undertake approx. $39 million of system investment in 2009-10.

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

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

Internal Control

The team visited the regional warehouse in Quetta and reviewed policies, procedures and operations. The QESCO 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 two field warehouses. The QESCO annual financial audit included observations with regards to the store shortages receivable from employees for Rs. 4,337,426 in FYE 2010. These shortage investigations are performed based on the WAPDA Manual of General Rules; Guidelines for Enforcing the Responsibility for Losses Sustained by the Authority through Fraud and Negligence of Individuals, 1982.

The team noted significant inefficiency in materials inventory management. The ratio of materials used to the average inventory balance is .93 as compared to over 2.0 for the average of all other DISCOs. For FYE 2010, the total value of material used compared to average inventory balance was Rs 2.1 billion and Rs 2.26 billion, respectively.

The Book of Financial Powers (BFP) is a governing document and was approved by the Board of Directors of QESCO. The BFP establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by QESCO management and Board in the operation of day-to-day activities. The Book was reviewed and discussed with the Company Secretary, also serving as Finance Director, regarding the adequacy of its monetary limits. QESCO is in the process of preparing a draft for proposed changes to the BFP, to effect more efficient approval authorities and adjust monetary limits reflecting current financial climate. and internal control standards. This proposal will be sent to PEPCO for approval.

In a review of the Internal Audit (IA) function, it was determined that IA operations employ approximately 42 people out of a total of 56 sanctioned posts. The dept. continues to employ the WAPDA Audit Manual dated August 1985. In addition to this, 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 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, are: 'to ensure that rules and orders framed/adopted by the Authority from time to time in connection with execution of works, pay and allowances, stores, etc. and for maintenance of various accounts, books, etc. are followed by all WAPDA formations/offices, and the defects and irregularities noticed in such accounts/ books rectified as far as possible". 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 the division's lack of independence and competence. The existing audit manual does not address the specific audit procedures as the organization has evolved and new system processes introduced.

The Manager Internal Audit emphasized the need for the revision of both Audit Manuals relating to Financial & Revenue Audit. He also emphasized that the IA should be reporting to the Board Audit Committee instead of, as presently, reporting to the CEO. PEPCO has sent instructions to all DISCOS in July 2010 to change to reporting hierarchy to the Board Audit Committee. IA desires these instructions to be implemented in true spirit once the new Boards are in place.

The external auditors have reported the following observations in their covering letter addressed to the BOD on the Financial Statements for the year ended June 30, 2010:

1. The Head of Internal Audit reports to QESCO's CEO and to WAPDA's Chief Internal Auditor.

2. The scope of the internal audit function covers the review of operational activities only.

3. The Internal Audit Department is behind schedule by a period of two years, and is currently in the process of carrying out field work relating to year 2008-09.

4. No internal audit of IT functions has been done.

The auditors have recommended the following measures to establish an effective and independent internal audit function:

1. The Head of Internal Audit should report to the Audit Committee of the BOD.

2. The scope and annual audit plan of the internal audit department should be formally approved by the Audit Committee.

3. Internal audit reports should be finalized and issued in a timely and efficient manner.

4. Management should conduct training courses on a regular basis to augment the knowledge of internal audit staff.

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 services 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 QESCO, vehicle fleet maintenance costs were discussed with the Director of HR. The QESCO vehicle fleet consists of a total of 471 vehicles, 144 of which are 20 years old or older. The company's fleet management policy requires replacement after ten years, while the private sector's period is usually five years. QESCO's position stems from PEPCO's ban on new vehicle purchase. To overcome these constraints, QESCO management has initiated a scheme for replacement of engines for vehicles requiring continuous maintenance. The utility generally replaces 15-20 engines annually, at a cost of approximately Rs. 300,000 to Rs 400,000. per engine, to overcome the increased maintenance cost of these vehicles.

With a high number of very old vehicles, vehicle maintenance costs are significant. Even though QESCO has a ten year replacement policy, this policy is not strictly followed. Even if the company were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy allowing for vehicle replacement .

QESCO is currently paying PEPCO approximately Rs. 2.5 million as a software license fee for three applications (billing, payroll and inventories).

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

Financial Reporting

The external auditors of QESCO have issued a qualified report on the financial statements for the year ended June 30, 2010, noting that: "The property plant & equipment amounting to Rs. 4,689 million were

transferred by WAPDA under Business Transfer Agreement (BTA) and Supplementary Business Transfer Agreement (SBTA). Further fixed assets amounting to Rs. 1,569 million and Rs. 231 million were transferred by WAPDA during the years ended June 30, 2005 & 2007 respectively. The values of assets transferred to the company represented unaudited values according to WAPDA records. Furthermore during the year ended June 30, 2008, assets amounting to Rs. 76.99 million were transferred by NTDC through the Project Director Grid Station Construction (GSC). The company has not carried out physical verification of property plant and equipment and hence could not reconcile its physical records. Accordingly we are unable to satisfy ourselves as to the existence and carrying values of underlying assets."

The auditors further reported the following observations in their covering letter addressed to the BOD on the Financial Statements for the year ended June 30, 2010: "Projects aggregating Rs. 17.921 million (2009: Rs. 219.5 million) have been certified by the respective line superintendent as completed, but these have not been capitalized because the Project Directorate Construction Office has not yet received the job completion certificate from its Consultants i.e. Barqab Consulting Services (Private) Limited. Furthermore, we have noted that during the year certain projects amounting to Rs. 223 million have been certified as completed by the Consultant, however the company has not capitalized these projects. Management should devise and formally approve a capitalization policy."

The company has hired M/S G3 Engineering Consultants for the revaluation and physical verification of all its fixed assets. In the opinion of the Finance Director, the auditors' qualification will be removed once the valuation of assets is completed. It is anticipated all work should be completed by June 2011.

The accounting units continue to depend on manual processing. QESCO is presently using certain stand alone software applications including inventories, payroll and billing licensed by Power IT Company. Current software applications require manual entries to the general ledger.

QESCO is currently evaluating the implementation of an ERP solution. Generally, an Oracle based system shall include the following integrated applications:

Financials

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

Material Management

1. Purchasing
2. Inventory management
3. Order management

Human ResourceManagement

1. Core human resource data base functions
2. Payroll
3. Self service

4. Recruitment
5. Expense management

Benefits should include:

1. Better control at all levels
2. Ability to facilitate day-to-day management reporting
3. Provide immediate access to enterprise information
4. Integrate various business functions
5. Produce more accurate information
6. Improve financial management and corporate governance

All DISCOs were required to convert to the NEPRA Uniform System of Accounts by December 31, 2010. The new chart of accounts will be more detailed than QESCO's current chart of accounts. The company has targeted meeting the June 30, 2011 deadline after acquiring necessary approvals from NEPRA.

QESCO continues to use a legacy WAPDA accounting manual that has become increasingly outdated due to changes in accounting practices in Pakistan. The QESCO Finance Director is desirous of updating the accounting manual after the implementation of ERP.

Financial Performance Indicators

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

For purposes of comparison, PDIP proposes to use financial and technical performance characteristics of the large group of rural electric utilities in the United States. These utilities are small in comparison to the Pakistan DISCOs; have far fewer consumers per kilometer of distribution line; but are characterized by low line losses and extremely high collection rates, and have been financially self-sustaining without capital or operating subsidies. For purposes of this comparison, the largest of the US rural electric distribution cooperatives were selected for this benchmarking process. These cooperatives range in size from slightly more than 80,000 consumers to over 200,000 consumers; DISCO sizes range from 400,000 to over 3 million consumers.

The current ratio is an indication of an entity's ability to currently pay its debts. Generally, a ratio below 1.0 means it may have trouble meeting these obligations. QESCO's current ratio of .57 needs periodic monitoring should its financial position worsen.

As discussed in the Internal Control section of this report, the team noted significant inefficiency in materials inventory management. The ratio of materials used to the average inventory balance is .93 as compared to over 2.0 for the average of all other DISCOs.

Maintenance expense as a percentage of operating revenue indicates that QESCO is spending significantly less than US rural electric cooperatives to maintain its electric system, 1.70% for QESCO

compared to 7.98% for rural electric cooperatives. However, this is somewhat explained by the fact that QESCO 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 QESCO has sufficient operating revenue remaining after power costs to support its existing plant through operations and maintenance expense when compared to rural electric cooperatives, 4.0 for QESCO and 6.3 for rural electric cooperatives. However, a significant portion of operating revenue is being absorbed by operating expense at 16.68% when compared to other DISCOs and rural electric cooperatives at 7.03%. The rural electric cooperatives have invested significantly more in total plant per kilometer of line than QESCO, Rs 2,622,327 for rural electric cooperatives and Rs 598,164 for QESCO.

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 QESCO than for US electric cooperatives and other DISCOs: QESCOs trade debt to operating revenue ratio is 12.6%, while the US electric cooperative average is 0.23%. This comparison is based upon FY 2010 QESCO trade debt.

US electric cooperative consumer density averages 8 consumers per kilometer, while QESCO has 13 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while QESCO's consumer to employee ratio is 73 to 1. Even though QESCO 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 QESCO able to achieve a consumer to employee ratio close to the US average, the savings would approach Rs 1.25 billion per year.

QESCO's negative equity and current year net income has resulted in a negative return on assets (3.8)%, equity as a % of total assets (35.7)%, and long term debt as a % of total capitalization (8.39)%.

Table 2.9 QESCO/US cooperative performance ratio comparison

Category/Performance Indicator	QESCO	US Cooperative Ave.
Liquidity		
Current Ratio	.57	1.6
Amt. over 60 days/Oper. Rev. (%)	12.6%	0.23%
Profitability		
Return on Assets	(3.8%)	5.07%
Op. Rev./km line (Rs.)	1,126,524	1,528,519
Consumers/km line	13	8
Consumers/Employee	73	467
Main Exp./Op. Rev. (%)	1.70%	7.98%
Op. Exp./Op. Rev. (%)	16.68%	7.03%
Cost of Power/Op. Rev. (%)	86.04%	70.55%
Plant Utilization		
PRR (one year plant rev. ratio)	4.0	6.3
Total Plant/km line	598,164	2,622,327
Solvency		
Equity/Assets (%)	(35.7%)	42.4%
Long Term Debt/Ttl. Capitalization (%)	(8.39%)	52.0%
Line Loss (%)	20.7%	5.0%
Elec. Sales Collected/Elec. Sales Billed (%)	69.0%	N/A
Government	60.8%	N/A
Non-government	77.0%	N/A

Commercial Management

Overview

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

Summary of Key Findings

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

- **New service connections --** 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.
- **Meter reading --** Numerous problems were found in this area. 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. Personal registers were used to note readings instead of official meter reading cards. Furthermore, QESCO does not employ a practice to remove, clean and calibrate meters.
- **Bill preparation --** The billing process involves manual data transfers and data entry, which often cause delays. All the data entry and bill processing is done at the Computer Centre. Processing is done in batches, so if one reading batch from any division is behind schedule, the entire batch is delayed.
- **Bill delivery --** The meter reading and billing schedule is not prepared with sufficient allowances for delays, resulting in bills being delivered to the customer on or after the payment due date. Delivery of bills is often by hand, so lack of transportation also routinely delays bill receipt and payment. In many areas bills are left at a single location, customers being responsible for their collection.
- **Bill adjustments --** Adjustments to consumer bills can be made at any center, but the adjustment data must be returned to the consumer's revenue office for further processing. Since there may be a substantial time lag in processing this adjustment, the consumer may have to return to the customer service center for another billing adjustment. In simple terms, the company's back-office procedures do not follow through with actually adjusting the consumer records.
- **Payments --** The payment handling arrangement is also fraught with inefficiencies and requires frequent, manual intervention. Most of the pay points in QESCO's command area are without online facilities. Scrolls and payment stubs are physically transferred to the revenue office for reconciliation; this usually takes three to four days. The stubs and scrolls are then transferred to the computer center for data entry/scanning. The bank will not accept payment amounts less than the amount indicated on the printed bill.
- **Disconnection/reconnection --** While QESCO's process for disconnecting/reconnecting delinquent customers is reasonable, it involves a number of separate departments and is not automated, introducing potential risks and delays. Each month 10% of the customers are issued disconnection notices, but few of these are actually executed.
- **Customer service --** QESCO, like other DISCOs, has no explicit performance targets for customer care and therefore this department is greatly neglected. There are only two (02) customer facilitation centers in QESCO, though complaint offices are present at each field office. At the local levels, there are no dedicated customer service representatives. Personnel are assigned to man the windows for a few hours and then return to their regular duties; hence there is little or no continuity in resolving customer issues. An efficient and effective customer care system is needed by QESCO and its counterpart DISCOs.

- **Meter maintenance --** Meter inspection, testing, repair and replacement are inconsistent at best. There are no meter testing/calibration labs at division or circle level. Established inspection 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.
- **Theft control --** Theft of electricity and related fraudulent activity that reduces revenue to QESCO is rampant. Agricultural customers, sharing more than 75% of total consumed units, are considered the biggest challenge in terms of theft control. As per QESCO's official statement, there are around 5000 illegal tubewell connections, causing an annual loss of around Rs. 4b, with 170MW of additional burden on the utility's network. Many instances appear to involve company employees as well. Reconciliation of customer meter readings to known area meter readings, which would highlight areas for investigation, has not been implemented.
- **Meter integrity and meter reading practices --** When a meter is declared to be defective, the consumer is billed either on the corresponding month consumption previous year or the average consumption of the last 11 months, whichever is higher. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer/winter. Since it takes 3-4 months for the meter to be replaced, the air conditioning /heating season is over before the consumer is billed on actual consumption again. Also, with many meters installed on the same pole and some located at heights of 7-10 feet above ground, it is difficult to detect meter tampering.
- **Information technology --** Presently, QESCO 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. QESCO struggles with lack of communications infrastructure at most of the field office locations and computer literacy among staff which makes IT implementation even more of a challenge. Stand alone 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 few issues on an ad-hoc basis rather than as a long-term, holistic strategy to achieve fundamental business goals.

Analysis & Discussion

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

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

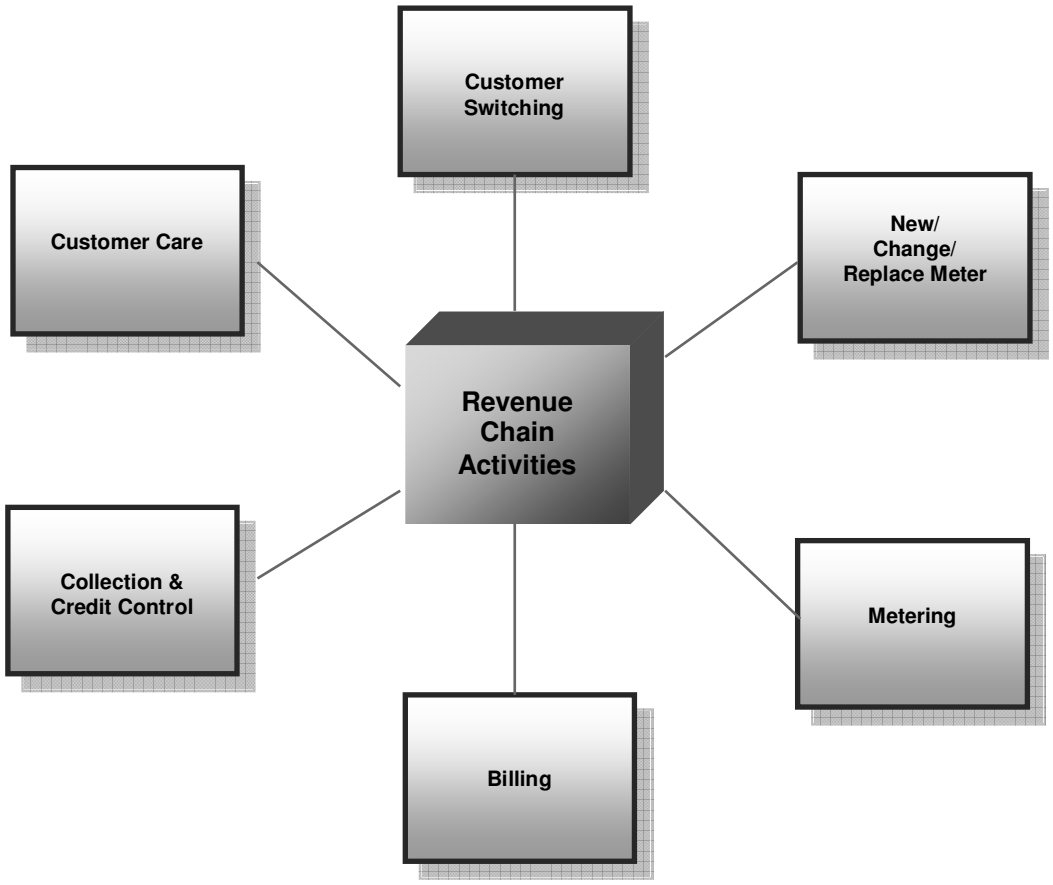
The Commercial Procedures manual is a true procedures manual developed by USAID in the 1980s, and is still the primary document for carrying out commercial activities. Revisions that have been made primarily raise authorization limits and reassign signing authority as needed.

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

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

Overview of Revenue Cycle

The revenue cycle is composed of a number of interrelated steps as described in Fig. below.



The first step – perhaps a pre-revenue prerequisite, is the application for service connection. There are non-recurring fees assessed in the application and connection process, so this is in fact a part of the revenue cycle process. Once a consumer has received a service connection and begins consuming electricity, the DISCO's revenue system must collect consumption data, process thisedata, 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 QESCO; much of this information applies to all DISCOs, since they all use very similar commercial practices.

New Connections

The first step in revenue cycle management, as noted above, is to register and connect the consumer. The location associated with the meter is identified as the consumer; that is, the premise is assigned a billing account number. Should the occupant of the premise change, the billing account number does not follow the consumer, and the name associated with the number is changed. Account numbers are assigned in the walk order of the meter route. A single digit supplementary number is available in the existing system to add new customers. Once the additional structures exceed the available account numbers, the route must be renumbered.

QESCO's new connection policy is similar for general and industrial consumers. The difference is in the documentation required and in who has the authority to approve the application. Table 2.10 below shows the sanctioning authority with respect to load.

Table 2.10 Load and sanction authority.

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

New connection forms are available online and at all QESCO offices. However, applications and supporting documentation must be delivered to the appropriate office. General consumers (domestic and commercial) can apply for service at the local subdivision office. Large consumers apply at the Circle or XEN office or at the Headquarters complex. Once the application and the terms of agreement are completed, signed and appropriate documentation attached, the application is assigned a registration number.

Within two weeks of receiving the application, the subdivision conducts a site survey to determine if there are any past arrears associated with the premise, if power is available for the connection, and to 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 demand note for the security deposit are prepared and sent to the consumer, who 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.

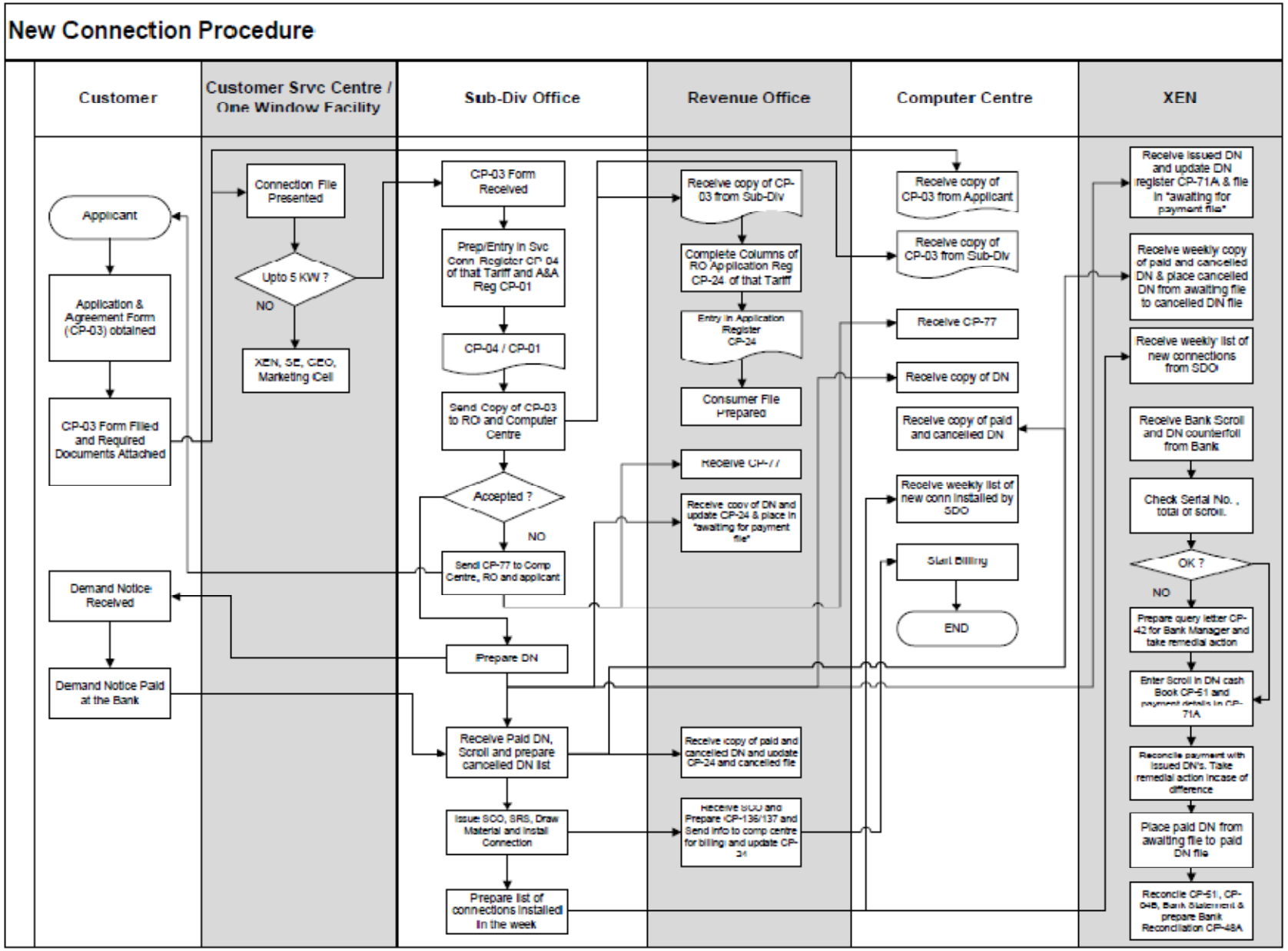
A service connection order (SCO) is prepared after the fees are paid. The meter, cable and necessary materials are drawn from stores, and the connection is installed. Unfortunately, the materials needed are often not available for several months after payment of the demand note. There is no communication between stores and the personnel preparing demand notes. Inventory has a computer system, but it is not integrated with other systems. The consumer will still pay his 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.

QESCO follows the prescribed process to some degree. The target is to have new connections installed 35-45 days after the registration of the application. However, this target does not take into account any delay of payment by the consumer or shortage of material in the warehouse. Data on the register used to notify the revenue office as to which connections had been completed indicated that average lead time for domestic connections is around 55 days. In some instances it was observed that new connection took over 4 months. Generally very few new connection applications are registered in QESCO.

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

The delay in billing the consumer is the result of the process, which is as follows. First, the sub-division prepares a summary of new connections and sends it to the revenue office, usually once a month. The revenue office prepares a "master data addition/change form" to send this customer information to the billing center. After data entry the billing center prints a "posted list" showing new connection details and sends it to the revenue office for verification. If the data is not correct, the corrections are sent back to the billing center by the revenue office through "master data addition/change form and/or consumer meter data change form". Once the data is verified and accepted as correct, the first billing cycle may have passed. Because the meter reading list is prepared just days in advance, the new consumer may have missed the first billing cycle by merely a matter of days. Fig 2.1 illustrates the new connection procedures.

Figure 2.1 New Connection Process



Meter Reading

The customer meter is the most critical component of the revenue cycle. Effective, efficient and reliable metering and recording of electric power consumption is at the heart of the electric power distribution utility commercial system. Many utilities experience significant difficulties in the meter reading process, including inaccurate or faulty meters; human error in recording and/or transcribing meter reading data; delays in recording and transferring metering data; and meter reading fraud involving consumers, meter reading staff 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 advance 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.

QESCO and its DISCO counterparts have employed checks and balances in the meter reading policies and procedures in an effort to ensure robust and trustworthy metered data from their consumers. Unfortunately, this is an 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 not 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 those that are noted.

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

Table 2.11 Meter auditing/verification responsibilities.

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

While these measures have been included in the QESCO/DISCO system, interviews with QESCO commercial staff and record sampling indicate there is little or no evidence that these procedures are actually followed. QESCO management and employees indicate that there is insufficient time to perform the randomized evaluations of meter reading accuracy; and the review of meter reader event logs revealed that readers are not consistently identifying problems with meters. This would indicate that meter reading verification/auditing functions should be assigned to a work unit with the specific mandate to undertake these duties.

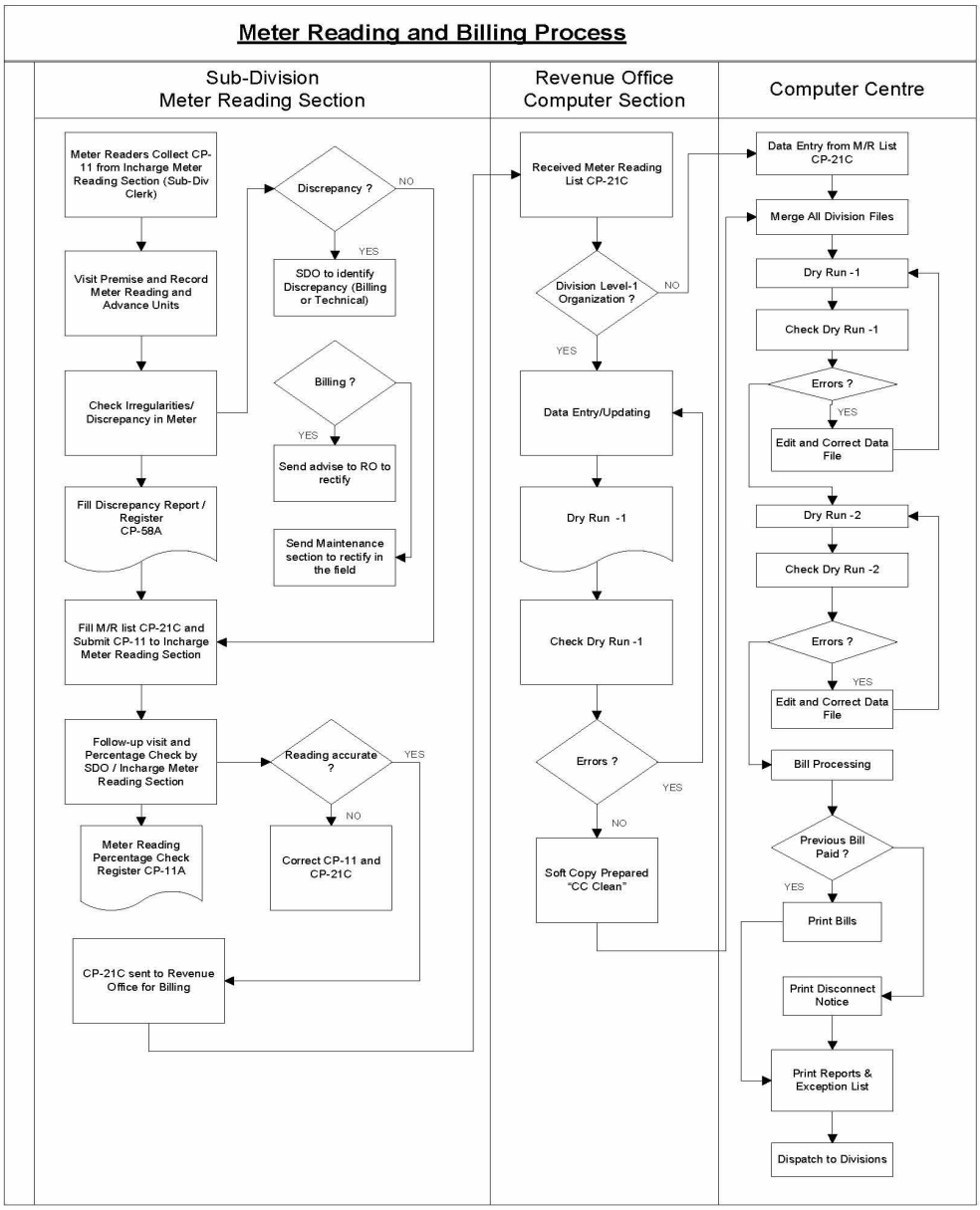
There are around 20,000 registered tubewell connections in QESCO consuming over 75% of the energy billed. The majority of these are not metered as customers have either damaged or removed their meters. Many of these metering discrepancies have not been reported leaving monthly energy assessment on those connections at the sole discretion of meter readers. In the absence of any field

or procedural check, excess units may be added to these agricultural customers to cover system losses.

In several field offices, meter readings are not collected on meter reading cards ie. kalamzu but instead taken on personal registers/books and later transferred to the kalamzu card and meter reading list.

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

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



QESCO segregates meter reading into a series of batches. Given that there are 20-23 working days per month, it divides consumers into 22 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 eight days after the meter reading.

The utility uses 20 batches to manage the meter reading and billing cycle for general consumers. In remote field offices, since there are fewer customers as compared to other DISCO averages, normally 5-7 batches are used for general consumers. These batches are read by the regular meter readers. In addition, a separate batch is used for reading MDI (industrial, tubewell and those with demand meters) customers, and another batch for Time of Use (TOU) meters with load between 5-20KW.

The reading list for each batch is supposed to include consumers on the same feeder. However this is not the always the case. QESCO commercial officers stated that exceptions are made where

feeders intersect; it is more convenient to read the meters on adjacent feeders when the meter readers are already in close proximity to them. The size of the batch is based on the number of readers and the "yardstick" of 2,000 meter reads per month. This may not be possible for rural/remote areas where customers are distributed on a large area. QESCO has more than 340,000 km^2 of area coverage, making it difficult for a limited number of staff to read meters every month. The law and order situation also makes it difficult for the utility staff to perform their duties as per given schedule.

The billing center has the target of printing meter reading lists 5-7 days prior to the scheduled reading date. The lists are delivered to the division office and then distributed to the subdivision offices. Some divisions in QESCO's southern circle are very far from the headquarters billing center; therefore air services are utilized for transportation of data. In some instances the lists may reach the meter readers 3-5 days after the reading date due to logistical problems. Because the lists are prepared so far in advance of the actual reading date, new connections go unread for multiple months. However, the readers do not use the reading list while reading the meters. Readings are recorded in Kalamazu books, or in personal registers, and later transferred to the reading list at the end of the day.

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

The date of the meter reading used for billing purposes is the date scheduled for the meter reading. Readings may actually occur 2-3 days before or 2-3 days after this scheduled date.

Bill Preparation

The meter reading lists from subdivisions are passed to the division's revenue office. The transfer process usually requires another day or so. Since there are no Level-1 divisions in QESCO, the revenue office sends the readings to the computer centre for data entry when all subdivisions under its control have submitted their readings. If one subdivision is behind schedule, the entire batch is delayed. Reading lists are delivered to the computer centre by hand. A commercial assistant from the revenue office is assigned the duty of managing all communications with the computer center. The center does the data entry and cleaning before processing/printing of bills. It may take 9-10 days to process meter reading data for a batch, assuming there are no delays in receiving the raw data and in data entry. A number of exception reports are generated during the process for information/action by field staff; these are however seldom pursued.

If closing for the previous month has not been completed, bill processing will be delayed. If all batches with the same number have not been received from all circles served by the center, bill processing may also be delayed. The issue date on the bill is not always the date on which the bill is printed. For the month of December, the scheduled issue date was frequently 2-3 days prior to the actual date of bill preparation. However, the due date on the bill is calculated from the issue date—normally 16 days from that date. No matter on what date the bill is printed, the issue date and thus the due date are the scheduled dates. The schedule allows 1-2 days from the print date for delivery to the revenue office.

The billing program being used by QESCO 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 bills and reports is done in SQL. The database is designed exclusively for electricity billing activity; however the COBOL program will not allow QESCO to include other revenues and security deposits in the bill.

This billing program was first developed by WAPDA, which originally programmed controls to ensure the integrity of the program and the data it contained. The program is now controlled by the DISCOs and many of its controls are now obsolete. There has not been a transactional audit since the transfer of billing centers from WAPDA to the DISCOs.

The QESCO billing centre is located in Quetta City. Customer service centers are connected to the system via the web so that duplicate bills can be produced. However bill adjustments must go through the revenue offices.

There are six revenue audit teams. They audit 100% of the industrial, tubewell and commercial billings with maximum demand indicators (MDI). The teams also audit approximately 5% of the general consumer bills. It takes 2-3 months to audit a revenue office. The audit is basically a comparison of documents to the billing database. Mostly under-billing cases are checked and reported. In FY 2007-2008, 1615 cases were detected at a value of Rs. 76.6 million. Almost 84% of the detected amount remained unrealized. During November 2010, 125 under-billing cases worth Rs. 12.08 million were detected, mostly due to incorrect estimates for defective meters or wrong application of tariff. However, the lack of trust between the subsidy providers and QESCO on the validity of the tubewell billings leads us to the opinion that the audit team is not peforming its function effectively.

The QESCO (and in general DISCO) bill format requires modification. The current version makes it difficult for the consumer to determine whether adjustments for previous months have been posted to his account, how any arrears (past due balance) amount have been determined, or what amount which taxes have been calculated on. For transparency, the bill should begin with the previous month's balance, show all transactions for the current billing period, and then the balance now due.

Bill Delivery

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

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

DISCO personnel are responsible for bill delivery. Bills are hand delivered to urban consumers. Because transportation is not provided, the bills for the rural areas are left at a single location, and the consumers are responsible for collecting bills from pre-defined central locations. This introduces another source of risk to the bill delivery process. It was noted that the majority of complaints (approximately 2,400 in the month of December) related to non-delivery of bills.

Bill Adjustments

Bills can be adjusted if required at the customer service centers. If the adjustment is for less than 500 kWh, the customer service manager has the authority to issue a provisional bill immediately in accordance with the reading reported by complainant. The reported reading is verified later and the bill correction if approved is made in the next billing cycle. Adjustments in excess of 500 kWh require verification by field personnel.

When bill delivery is not timely, consumers may request an extension of one to five days. If a consumer makes a request for partial payment of a bill, the CSR may authorize installments of two to three payments. Due to the fact that meter readings are sometimes estimated rather than read, actual

readings in subsequent months can have the result of pushing some consumers into a higher tariff slab. The consumer bill may be segregated into several periods to lower the total bill, allowing the consumer to avoid the higher tariff rates. Bill segregation is at the sole discretion of utility staff, with no followup procedure in place to establish correctness and responsibility for such correction. Table 2.12 below illustrates the responsible parties and levels of authority granted for commercial account control.

Table 2.12 Delegation of installment authority

Sr. #	Authorized officer	Category of Connection	Amount in Rs	Installment Authorized
Disconnected Connections				
1	SDO	Domestic & Commercial	5,000	2 to 3
2	In-charge Customer Service Centre	Domestic & Commercial	15,000	2 to 3
3	XEN / Dy. Dir Commercial	All	50,000	2 to 3
4	SE / Manager Customer Services	All	200,000	2 to 3
Running Connections				
1	SDO	Domestic & Commercial	5,000	2 to 3
2	In-charge Customer Service Centre	Domestic & Commercial	15,000	2 to 3
3	XEN / Dy. Dir Commercial	All	50,000	2 to 3
4	SE / Manager Customer Services	All	100,000	2 to 3

The Customer Service Center has pre-printed forms for the most common adjustments—extensions of due date and installments. The installments apply only to the outstanding arrears. The consumer must pay the current charges and the first installment. The deferred amounts may be charged a mark up at the prevailing bank rate (currently 14%).

Adjustments to consumer bills can be made and approved at any center, but must be returned to the appropriate revenue office for final processing. The problem that may arise is the time required to deliver the adjustment to the consumer's revenue office and the time the adjustment is actually entered into the computer. The data entry for the adjustment is made at the computer center in the same batch that contains the meter readings for the month since there are no level-1 divisions in QESCO. If there is a substantial time lag, the consumer may have to return for another bill adjustment. In other words, the back office procedures do not follow through with actually adjusting the consumer records. In a review of the complaint statistics for the month of December at one customer service center, the number of cases related to posting of arrears were outnumbered only by those regarding non-delivery of bills.

Payments

As noted earlier, payments to QESCO can be made at any scheduled bank, at local post offices, at NADRA kiosks, or electronically. The company receives the majority of funds through banks and post offices. Payments through NADRA account for under 5%.

As payments are received, the pay points prepare scrolls documenting the customer accounts and the amounts paid. If the banks have online facilities the customer information may be transferred electronically. For those pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. The revenue office reconciles the number of stubs and scroll entries; this process usually takes only one business day. If the bank forwards the scrolls and the payment stubs daily, it takes three to five days from the date the consumer makes his payment until it is received by the computer center. Personnel at the computer center will scan the payment stubs and reconcile the amounts to the scrolls.

Pay points will not accept payment amounts less than the amount indicated on the printed bill. If the bill has been adjusted by the utility, the revised amount due is written on the bill. However, since

bills are bar coded, adjustments require manual intervention when scanning the stub for data entry. The actual due date is included in the bar code. While scanning the receipt, the computer will adjust the amount billed for the late penalty. If this does not agree with the scroll, the scroll amount takes precedence.

The money, net of collection fees, is usually transferred to QESCO's collection account weekly/fortnightly. The timing of fund transfer is dependent upon the agreement between the utility and its pay points. Transfers are not actively tracked by the respective revenue offices. QESCO reports that the cash in transit amount is approximately 12-14%.

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

Disconnection/Reconnection

The billing/collection program automatically prepares a list of delinquent consumers and equipment removal orders for all who have not paid their outstanding balances within the grace period. The list is reviewed and edited at the revenue office. The revenue officer has the authority to selectively delete consumers from the list after verifying payment against office records; the equipment removal orders are thereafter cancelled. Details of payments received at the revenue office are recorded against corresponding consumers in the disconnection list. This actual list is manually prepared due to the time lag between computer preparation and adjustments for payments received.

A premise may also be disconnected for a specified period at the written request of a customer, who. has to commit to paying the monthly minimum charges at the time of reconnection.

The list of delinquent consumers, equipment removal orders and cancelled orders are sent to the revenue officer, and thereafter forwarded to the technical department for execution. On a periodic basis, the revenue officer is required to review the status of equipment orders to ensure that services have been disconnected. When equipment orders are executed, QESCO technicians remove meters and services from the customer's premise, to be stored in the subdivision warehouse. Documents reviewed at a QESCO division office revealed that approx 10% customers are issued disconnection notices each month. Very few notices are actually acted on owing to legal and other impediments. Approximately 24% of the utility's registered customers are permanently disconnected.

If the consumer pays all amounts due within one year, the 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, he may be reconnected required to pay for a new service connection. The consumer is credited with the depreciated value of the equipment removed, but must pay for a new service and meter. After three years, he is required to pay the current security deposit and the full equipment costs.

Customer Service

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

- applies for a new connection or change of service;
- receives the monthly bill, pays the bill, or otherwise communicates with QESCO;
- communicates with QESCO to obtain information, review the bill, request for meter inspection, or make a complaint.

Each QESCO field office has a customer service facility, as well as a regional complaint centre located at the Headquarters complex. In addition, it maintains a central Customer Service Office in Quetta City that operates round the clock with a staff of 16 working in shifts. The Quetta center has a Universal Access Number (UAN) for registering telephone complaints as well.

Consumers may lodge complaints at any customer service center as well as at the subdivision office. The Headquarters Complaint Center is not actively used by consumers for registering complaints. Customers more typically report problems at their nearby field office or customer complaint center. Complaints are registered in log books according to category. The customer service personnel have the authority to adjust consumer bills up to 500 units (kWh) and to sanction upto 3 installments for bills less than 10,000 rupees. A toll free number is also provided to customers to report theft. Registers were well maintained at the Quetta City CSC.

There are no dedicated customer service representatives in QESCO's territory. Complaints are handled by the SDO and XEN and other field staff. If the complaint requires an adjustment to the customer's bill, the change is entered onto the bill and the customer is free to then pay his bill. There are no companywide consolidated statistics for complaints. However, individual office records show that the majority of complaints relate to billing issues.

Commercial Department Organization

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

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

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

The revenue officer posted in 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 reconciling of weekly bank statements with the cash book and of debtors control accounts. This official is also responsible for accounting matters under procedures laid down in the Divisional Accounting 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, maintaining connection application registers, and files for each consumer.
- Billing Control Section: responsible for controlling meter reading and data delivery to computer centers; ensuring that billing is correct; making adjustments to inaccurate or incorrect bills; issuing disconnection notices; preparing certain management reports and statistics; bill dispatch.
- Debtor Control Section: responsible for controlling the computer prepared debtors ledger; balancing ledgers; carrying out debt recovery action; maintaining debtors' control reports and statistics.

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

Analysis of Changes in Revenue Cycle Practices

Agricultural (tubewell) connections constitute a major portion of the net company consumption but their collection is the lowest in this category. This is primarily because of removal of government subsidies in June, 2010 on these connections. To assist farmers in Balochistan province, federal and provincial governments extended the subsidy on tubewell connections where each consumer was required to pay Rs 4,000 as a fixed monthly charge. The remaining balance was paid through subsidies shared by provincial government, federal government and QESCO in the ratio of 30%, 40% and 30% respectively. Collection of agricultural customers prior to subsidy removal was around 75% but has subsequently dropped to less than 10%. Company receivables currently stand at Rs. 24 billion.

QESCO's sales mix suggests that any change in revenue cycle for categories other than agricultural will not improve the recovery as much as will changes in revenue cycle for agricultural consumers. Potential savings accrued from improved metering and meter readings on these customers are substantial if there were a better mechanism to monitor and enforce payment.

The revenue system could work more effectively if its practices and procedures were implemented with greater discipline. Many of the registers were not produced; those that were inspected were noted as incomplete. There have been complaints that work cannot be completed as the staff is preoccupied in completing the registers.

However, undocumented transactions (i.e. administrative losses) are a cause for alarm. The calculation of technical losses and energy accounting would allow a better reconciliation of deliveries and amounts billed. Comparing losses of the current period to prior periods is not an accounting of energy. It merely perpetuates the previous error.

Because there is such reliance on the meter reader in the revenue cycle, more rigorous controls and oversight are required of these readers and the reports they produce. It is impossible to assert effective transactional control if there is collusion between the meter reader and other parties in the revenue cycle. Although there are procedures in place that would provide some of the needed oversight, they are not adequately observed or performed in timely manner.

It was observed in several field offices that meter readers are not recording readings on Kalamazoo book but using personal registers instead. In many instances, meter reading logs had not been updated for several months. Because of remote locations, a large service area and the lack of transport, meter reading of remotely locaated consumers is not done on a monthly basis, and to make matters worse, the meter reading checks on these remote installations is also infrequently performed. In the absence of field checks and proper maintenance of meter reading logs, accurate energy accounting is difficult to validate.

Manipulation can also occur while preparing the reading lists used for billing purposes. Distribution losses may be hidden by adjusting consumption of selected meter reading upwards. The addition of consumption to various consumers can also be used to manipulate revenue and allow managers to meet performance targets. Since many tubewell connections are not properly metered in QESCO, energy usage estimation is at the sole discretion of the meter readers.

Some of this manipulation may be uncovered during data entry by comparing the recorded consumption with calculated consumption at an 80% load factor. The load used in the calculation is the sanctioned load declared when the customer applies for a connection. A warning is issued when the consumption is excessive, and an exception report is prepared. Similar to the exception report, when the consumption calculated by the computer differs from that calculated by the meter reader, action is seldom taken.

The preparation of meter reading lists can be eliminated altogether through a change in technology – or a combination of changes such as automated meter reading with handheld devices. These readings are uploaded to the billing program, eliminating the need to manually enter the data and manually calculate consumption.

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

To prevent newly connected/reconnected consumers from going unbilled for several billing periods, logs of prepared service orders and status should be kept and reported on. As material is issued from stores against Service Connection Orders (SCO), there should be a mechanism to update computer centers and revenue offices on impending connections so that billing can be started immediately. This would put checks and balances on field offices as well. Service orders should be in duplicate and copies sent to the revenue office, which should be responsible for followup if the order has not be cleared within a reasonable and specified timeframe.

When a meter is declared to be defective, it should be replaced immediately. If the utility had its own meter lab it would be possible to fix, recalibrate and return it to stores to be reused. If it is not economical to repair the meter, it should be dismantled for spare parts to be used in future repairs. However, given that all meters in Pakistan are hermatically sealed, it is not possible for QESCO to recalibrate the meters inhouse, and will have to send them back to the meter manufacturer. Therefore, in this current scenario, meter re-calibration is not possible. Periodic meter inspection/maintenance could be outsourced to a third party, or made part of a purchase agreement under extended warranty/maintenance contract with the supplier to check and fix meter issues in the field.

When the service connection order is prepared, the consumer should be established and entered into the meter reading list and the reader's Kalamazu book. The reader should track the progress of the installation while reading meters, and would be able 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 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 acquire electricity through dubious means. QESCO will have better control of its system; dangerous situations may be averted; and satisfied consumers shall be more likely to pay their bills, and on time.

Political interference in staffing, employee transfers and postings, disconnection of consumers in detaul, and in resistance to the removal of illegal connections, is compounding the company's poor financial picture. At the energy conference in Lahore in November 2010, the CEO stated that approx. 5000 tubewells were illegally connected, burdening the utility with an extra load of 170 MW. Because of high political involvement, QESCO is unable to disconnect these, causing a loss of approximately Rs. 4 billion annually.

Meter Maintenance

Meter surveillance is done by the metering and testing (M&T) teams, but the primary responsibility rests with the meter reader. Industrial meters are checked by an M&T team every six months. The testing procedure is performed in the presence of the industrial consumer. Other meters will be tested if a consumer requests a test, if the utility employee reports an abnormality in consumption, or if 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, ie. above eye level. It is doubtful that those meters are actually read, and thus any damage/abnormality would go unnoticed.

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

Meter replacement is done if the meter is reported defective. The meter discrepancy report/log of defective meters is updated by the meter reader; such logs may not be maintained in some subdivisions. The logs reviewed revealed that the entries are not numerous, and that most meters were declared functional by the line superintendent after checking by the M&T team. It may take several months to replace defective meters. In case of tubewell connections, where meters are either removed or damaged by the customer in the majority of instances, utility staff does not declare them defective as it is suspected that the customer may damage/remove the replaced meter too.

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, the serial number is recorded in the Kalamazu book and in the consumer's computer file. The latter are however not updated in the case of any meter change at a later stage.

Advanced Metering

To improve the billing process, automated meter reading should be installed not only on the premises but also at delivery points. AMR's can go a long way to improve transparency between the tubewell consumers and QESCO. AMRs will eliminate transcription errors and reading errors as well as manipulation of readings by/for consumers or management. The data can be loaded directly into the computer system. These meters result in real time consumption data provided directly to the utility. Consumer usage can thus be monitored from a remote point of access such as QESCO's Commercial Department. Given that the tubewell consumers have subsidy provided by the provincial and federal government, a higher level of transparency and accuracy on meter reading will go a long way in reducing the tubewell subsidy receivable for QESCO.

Meter Reading and Bill Delivery Practices

Although meter readers are assigned less than 150 meter reads per day (70 per day in rural areas), many are not able to read the full complement of meters. 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 the DISCO and for the consumer.

QESCO states that meters readers are being rotated. The procedure requires reader rotation every six months but is not followed in all sub-divisions. Rotations may be in form only, as readers may exchange reading lists once out of the office. The team received a copy of an office order document ordering the rotation of readers.

Meter lists and routes are not defined for individual feeders, which complicates energy accounting. 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 readers are not rotated or are constricted by trade union representatives, this has led to a lack of transparency and accountability and of the required level of checks and balances needed for program integrity.

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

Theft Control

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

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

Meter readings submitted for billing purposes are reportedly influenced by the management of the divisions and subdivisions in order to meet revenue and loss targets. Some consumers are overcharged because of excess readings to compensate for the under billed consumers. Readings 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. It is felt that the overall losses for QESCO would be higher than reported if the tubewell consumers are accurately metered.

Meter Integrity and Meter Reading Practices

When a meter is declared to be defective, the consumer is billed either on the corresponding month consumption previous year or the average consumption of the last 11 months, whichever is higher. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during seasonal peaks. Therefore, the reader declares the meter defective and the consumer is billed on the lower estimated consumption. Since it takes 3-4 months for the meter to be replaced, the seasonal peaks may pass before the consumer is billed on actual consumption.

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

During site visits and while interviewing field staff, the PDIP team learned that tubewell metering is ineffective and in some cases nonexistent. QESCO maintains that meters have either been damaged or removed by the customers. Many of these discrepancies have not been reported on the pretext that replacement meters will again be damaged or removed. Billing is done on an estimated basis by the meter reading clerk.

Customer Information System

Presently, QESCO distribution system practices are characterized by manual and cumbersome processes, inadequate controls, insufficient commercial focus, limited transparency and lack of reliable information. As a result, commercial operations are highly inefficient with substantial revenue leakages and poor customer orientation. The use of information technology to improve efficiency and effectiveness is inadequate. Several standalone applications are limiting the 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, isolated issues rather than as a long-term, holistic strategy.

The following are some examples of inefficiencies:

- A number of new connections are pending even after paying the capital cost and security amount because there is no material available in stores. Availability of service materials is not confirmed prior to issuing the Demand Notice. An integrated materials management and work order module would allow QESCO to order materials when needed, and connect consumers on a timelier basis.

- QESCO 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 major vulnerabilities that can be easily exploited.

- The customer services activities are not automated. A principal problem is that customer account records cannot be updated real time, i.e. the bill is revised manually but in many cases the same amount appears as arrears in next months bill.

- Delayed billing due to a non-distributed billing/data processing system increases bill processing and bill collection cycles, i.e. before batch processing can begin the computer center waits for data to be transferred from all three circles under its jurisdiction. Each circle awaits the transfer from all its divisions; each division is waiting on all its sub-divisions. The geographic distances increase this delay.

- Only one months billing information is available on computer master file, and historical data is offline i.e. in tape cartridges. Thus no trend analysis/drilling to find the gray area of business could be performed.

- Delayed cash processing/posting (more than 10 days in some cases) delays the cash reconciliation process. Information to management is likewise delayed.

- Delay by banks in remitting money to company's account due to the cash collection policy.

- No historical computerized record of service complaints.

- No computerized system for transmission loss calculation.

- Field staff is engaged in multiple activities, eg. maintenance of documents/registers at many levels, copying information from one form/register to another etc.

- Resistance by non-IT users to using new technologies is a key hindrance in improvement of the customer-utility relationship.

Human Resource

Overview

Interviews of management and staff held at QESCO have led to the conclusion that the DISCO is facing significant challenges in its HR functions. There is no real motivation for its employees, as superior performance is generally not recognized officially, and accordingly work productivity is low.

This situation is further impacted by the current adverse law and order situation. QESCO has not yet developed a strong and progressive corporate environment; in which management and staff have clearly-defined responsibilities and objectives, adequate authority and acknowledged accountability.

For all intents and purposes, QESCO uses WAPDA legacy HR policies and procedures, and does not reflect the values and attributes of a modern, dynamic and well-managed electric distribution utility. Results of the assessment process showed that management is not clear whether it reports to the Board of Directors, to PEPCO, or to MWP. Owing partly to this factor, governmental (national) plus internal political pressures are commonly and effectively exerted on QESCO senior management.

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 QESCO has been subject to both internal and external manipulation – by political sponsors, government agencies, trade unions, and employees themselves.
- The utility 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 all employees appreciate their accountability.
- The HR department of QESCO lacks a structured HR strategy which defines goals and objectives in line with those of the company.
- QESCO's performance has further deteriorated due to the prevailing law and order situation in Balochistan. Absenteeism and high levels of de-motivation amongst employees are widespread.
- Results of the interview 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 QESCO senior management.
- There is lack of transparency in hiring and career advancement within the company. Clear and transparent HR-related rules and regulations are lacking, as are the necessary checks and balances in the system to foster an atmosphere of fairness and impartiality regarding the annual performance review process.
- QESCO's corporate environment has not evolved in ways that reflect a modern, independent electric distribution utility. Employees appear locked in an archaic WAPDA/public sector mindset, where employment till retirement is guaranteed, and promotion based on seniority rather than performance.
- The compensation system makes no distinction between "performers" and "non-performers," nor does the system adequately reward high risk jobs, such as those of linemen.
- QESCO salaries are artificially low as a result of continued adherence to government salary scales, but while they may result in savings to DISCO operating cost, these savings are in fact artificial; perennially underpaid employees cannot be expected to perform at peak levels. Experience from other countries show that low compensation levels have been linked not only with poor performance but also with tendencies to engage in corrupt work practices.
- QESCO has developed certain job descriptions for various staff, including some senior management positions, however the PDIP review revealed that these are not yet fully updated, the job descriptions do not have key accountabilities or performance indicators, and essentially perpetuate the Area Electricity Board post descriptions. These documents lack clear and specific definition of roles and responsibilities, required educational background and professional experience; core competencies; and scope of authority and responsibility.

- The QESCO HR Department has not developed a personnel information database. Most employee information is maintained only in their personnel files. Hence the utility needs to develop a modern human resource information system with the planning and reporting capacity to carry out rigorous manpower analysis, recruitment planning, performance management and web-based facilitation, to fulfill the needs of a modern electric company.
- QESCO's Regional Training Center was found to be in much better shape than those of the other 7 DISCOs. However, improvement is still needed in curriculum development, training tools, and uplifting of housing facilities for trainers and trainees. Additionally, there are no Circle Training Centers at QESCO, and linemen from all 3 circles are trained centrally at the RTC in Quetta.
- While QESCO provides capacity and safety training at its Regional Training Center, the linemen trainees are trained with some equipment/tools not commonly provided to them in the field. These line workers are in general not adequately provided with basic line tools and equipment required to perform corrective maintenance and line operations in a safe and effective fashion.
- The health coverage for employees and their eligible dependents is poorly structured, requires considerable administrative overhead and supervision, and imposes considerable hardships on employees.
- QESCO senior management has a vision for the companys development, but this has not been effectively communicated to mid-level management and staff, and is therefore not well understood by employees.
- Recruitment of talented personnel is inhibited by the lack of effective job descriptions, comparatively low wage scales, and political and administrative involvement in the hiring process.
- QESCO does not employ a corporate performance management system. Instead it uses the standard GOP annual performance review program that is not based upon goal setting or objective performance evaluation.
- The company has not yet developed an Employee Handbook.

Analysis & Discussion

QESCO continues to employ the old WAPDA hiring and promotion processes, as do all other DISCOs. The main problem with this is that the process of hiring and career advancement places more emphasis on seniority rather than performance, and hiring is often dictated by external agencies, such as the Ministry of Water and Power and PEPCO. This results in a dissatisfied workforce. Clear and transparent HR-related and other rules and regulations have not yet been established, and there is a lack of necessary checks and balances required to foster an atmosphere of fairness and impartiality with respect to the annual performance review process. The QESCO corporate culture has not yet evolved to reflect a modern, independent electric distribution utility. Employees appear locked in a historic WAPDA/ public sector mindset, where once employed an employee continues to be retained and is promoted on seniority rather than performance.

QESCO faces the challenges of commercializing energy distribution over large areas, managing capital resources to finance system expansion and maintenance, upgrading its billing and receipts structure, etc. This requires professional HR management, technical, and a variety of other skills/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 or procedures. The organizational structure is

inherited from the WAPDA years, with scant emphasis on aligning QESCO to the changed business, engineering and financial environment.

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

Modern HR Practices

Throughout QESCO staff at all levels stressed the need for fair and transparent HR practices. The need is for an HR management system based upon accurate and uptodate job descriptions, key performance indicators, and fair and rigorous appraisals. The lack of such a system is the root cause of problems at QESCO. Corrective actions need to be taken in this area, and other areas such as commercial, engineering and financial, i to obtain the desired results.

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

1. Post descriptions complete with education requirements, training certifications, and experience for all positions in the company.

2. A fair and transparent hiring process allowing the HR department to recruit professionals in an objective manner, without external or internal influence or interference.

3. A merit based career and progression structure and policy which defines the prerequisites for promotion, and is applicable to all positions.

4. A progressive and competitive compensation and benefits package, independent of government compensation levels, and adjusted to reflect market rates for all professional and skilled positions.

5. A newly defined health policy providing increased flexibility to employees, allowing them to seek and receive health care beyond WAPDA-centric health facilities.

6. A skill oriented capacity building program to address the training needs of all tiers of the organization. To establish the learning culture senior management should promote training and other educational activities within the company.

Analysis of Manpower

Long-term performance improvement will require significant changes in human resource management and capabilities. A review of manpower HR statistics was undertaken to begin to understand how resources are allocated, and how well-prepared QESCO employees are to meet the requirements of their positions. Table 2.13 below summarizes manpower statistics at the utility. It indicates that of the total 7,168 employees, 1,221 or 17% are university graduates; 4,133 or 58% are educated at the secondary level only up to tenth grade; and 25% have merely primary education. Additionally, less than 0.5% are women.

Table 2.12 Manpower statistics

Manpower Distribution	**Strength**
TOTAL	**7168***
Total Officers	270
Total Officials	6,898
Regular Employees	6,303
Contractual Employees	836
Daily Wages Employees	29
University Graduates	1,221

Secondary Education	4,133
Primary & Complimentary	1,570
Others	244
Female	25
Male	7,143

Source: QESCO HR Department Data
* Updated information with reference to PEPCO DISCO Performance Statistics, June 30th, 2010, due to manpower sizing, attrition etc.

Table 2.13 shows that ~ 15% of employees are not properly categoried by occupational stream (shown as Others); this number is not as high as in the other DISCOs but is still reasonably high.

Table 2.13 Distribution of employees by department

Employees by Department	**Strength**
Executives/ Directors	25
Human Resource and Admin. Department	441
Finance Department	118
Operations Department	4038
Commercial & Sales Department	200
Administration Department	
IT/ MIS Department	51
Health & Safety Department	85
Construction Department	570
Training Department	24
Audit Department	45
Security Department	478
Others (store, school, civil etc.)	1093
Total	**7168**

Source: QESCO HR Department Data

Table 2.14 shows a snapshot of QESCO employees' time in service. It demonstrates that 92% of the employees have been in service for more than 11 years and 72% have been in service more than 20 years, showing that a significant number of utility staff have been in the legacy WAPDA organization for many years. The challenge of changing the corporate culture will thus be significant. The demographic distribution shows interesting results; approximately 33% of QESCO's employees will retire within the next 15 years. Therefore a reduction strategy relying on attrition through retirement alone can be an effective tool in reducing the company's overall strength.

Table 2.14 Distribution of employees by years of service and age bracket

Year Of Service	**Strength**	**Age bracket**	**Strength**
0-5 years	162	30 and below	695
5-10 years	705	30-40	1,279
10-20 years	1,107	40-45	2,842
Over 20 years	5,194	45-50	1,801
		Over 50	551
Total	**7,168**	**Total**	**7,168**

Source: QESCO HR Department Data

Compensation Analysis

A detailed market survey will be required to evaluate market-competitive levels of compensation for QESCO employees. The data collected and evaluated thus far indicates that salaries and benefits are far below the reasonable levels needed to retain valued employees. There is an obvious need for the utility to carry out a comprehensive review of all benefits, and come up with a standard and uniform structure for a benefits policy and related amounts.

DISCO regular employees are compensated through 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 which there is no distinction between "performers" and non-performers". The system does not reward high performers, or jobs with high risk, such as linemen, who prefer to move to other positions or ask for early retirement.

An exception may occur when an employee is hired on contract basis such as personnel occasionally engaged as DISCO Directors (eg, Directors of HR, Legal or Finance Departments). The pay package for such employees is considerably higher than for regular DISCO employees and is not constrained by the BPS.

A brief comparison of the salaries and benefits of QESCO with those for similar positions in NESPAK, NEPRA and PTCL (table below) will show that QESCOs salary package is by no means attractive. For instance the Chairman NEPRA draws over thrice the salary of QESCO's CEO, whose renumeration would be equivalent to that of a newly qualified engineer employed in the private sector.

To arrive at a more definitive answer to the question of desired compensation and benefits package in a private sector entity, there is need for a market-based survey, with a much broader scope and presumably carried out by a professional HR firm under PDIP. However such a package will be possible only when the company is freed from government control. Table 2.15 below provides a comparison of payscales between QESCO employees and those of similar levels in NEPRA, NESPAK and PTCL.

Table 2.15 Comparison of QESCO and other institutional salary levels

DISCO		**NEPRA**		**NESPAK**		**PTCL**	
	Rs'000		Rs'000		Rs'000		Rs'000
CEO	101	**Chairman/Member**	382	**CEO**		**President**	Spl Pkg
Director / Chief Engineer	91	**Director General**	338	**Exec. VP**	278	**Exec. VP**	425
Mgr. / Superintending Engr.	85	**Director**	265	**Gen. Mgr.**	217	**Gen. Mgr.**	287
Deputy Mgr. / Exec. Engr.	67	**Deputy Director**	203	**Principal Engr.**	114	**Sr. Mgr.**	170
Asst. Mgr. / Sub-Div. Mgr.	56	**Asst. Director**	140	**Jr. Engr.**	84	**Asst. Mgr.**	90

Organization

The organizational structure employed by QESCO is designed to employ distribution circles as large geographic management units managed as full service utilities – minus engineering planning. Circles are managed by Superintending Engineers empowered with responsibility to manage all operational activities except planning and engineering functions, which are managed at the HQ level. That is, commercial functions (meter reading, bill processing, and bill delivery) and line operations (connections and disconnections) are all supervised by the Supt. 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 functions are the cash register of any utility, the Commercial Department should not report to the Operations Department. The Operations Department manages the operation and maintenance of physical assets, focusing on power quality and reliability. The Commercial Department measures the success of the Operations Department and therefore must be independent and managed by personnel with the educational and experiential background, as well as the institutional objectives, for optimizing distinct objective functions. Commercial activities should aim to effectively manage the processes 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 consume

Distribution system operations focus on operating and maintaining this system's infrastructure including recording bulk energy transfers into and out of substations; performing substation and line maintenance; and managing minor system expansion activities.

QESCO'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 ensuring the DISCO progresses towards financial sustainability, should be unencumbered by distractive administrative responsibilities. Engineering planning, operations, commercial functionality, administration and financial affairs should all be routinely managed by highly competent managers, with CEO involvement limited to setting objectives and reviewing progress towards higher level achievements.

Human Resources Organization and Management

In additional to functionality challenges, the Human Resource Department is faced with organizational issues.The Deputy Manager Labor & Litigation currently reports to the Director HR/Administration, whereas the legal counsel should report directly to the CEO. It is proposed that this function be up-graded to Legal & Corporate Affairs. QESCO has over 100 legal cases in different courts. All HR functions are currently managed in the Head Office; there are no HR representatives at its circles. Basically the company relies upon administrative staff to manage human resource issues at the circle level, but these employees have no training or expertise in conducting HR activities or in advising staff on their rights and obligations regarding the company.

QESCO HR department has not developed an employee's database, instead maintaining personnel paper files. Therefore there is a need to establish an HR Information System would allowing the digitization 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

There have been 16 fatal and 11 non fatal accidents in QESCO in the past 4 years (see Table 2.16 below). Most of those injured have become permanently disabled and cannot be assigned to any active duty but receive payment and other benefits through retirement. The number of fatal accidents has risen from 1 in 2009 to 6 in 2010, and this is alarming.

Table 2.16 QESCO accidents over past four years

period	EMPLOYEES		TOTAL
	FATAL	NON FATAL	
2007	4	1	5
2008	5	Nil	5
2009	1	5	6
2010	6	5	11
Total	**16**	**11**	**27**

QESCO has not yet developed and deployed safety awareness programs or given the subject any priority with respect to either its employees or its consumers.

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

Safety training to advise consumers on the proper use of electric power – and the risks involved in inappropriate contact with power systems – has similarly not been adequately addressed.

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

In addition, QESCO 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 for provide primary care for employees and family members.

The health coverage for employees and their dependents is poorly structured and involves considerable difficulties for employees. Employees and dependents are forced to use the WAPDA central hospital in Quetta or a peripheral health care center, requiring considerable travel, or without the facility or required services. Alternatives such as choice or treatment venue, better health care through insurance, or paying a fixed proportion of salary for outdoor treatment, have not been evaluated or proposed for serious consideration.

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 both within and outside the company.

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

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

The recruitment process itself is often short-circuited by direct appointments made by PEPCO and/or MWP. This practice violates the concept of an independent electric distribution utility, and has forced QESCO and other DISCOs to absorb professionals into positions for which they are 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 2008-2010, period, 328 or 54% out of a total 610 new recruits were based on this quota. It is imperative that fair and transparent policies and procedures are adopted to put a curb on both these menaces.

Performance Management System

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

An effective and focused performance program needs to start with well-defined position descriptions that establish the performance expectations of employees, the core competencies, reporting requirements, and professional demeanor that is expected of each employee. The 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 the year end. For all intents and purposes, advancement is based almost entirely on seniority – not on achievement, so there is little incentive for employees to improve skills and to generally invest themselves in their jobs.

HR Policies and Procedures:

QESCO has not developed a consolidated and easily accessible set of HR policies and procedures manuals available to its management and staff. From recruitment to termination, clearcut rules and procedures are required. In the place of policies and procedures that should serve QESCO needs as a large and growing corporate entity, it has continued to employ legacy WAPDA HR policies that reward longevity and seniority, rather than high performance and dedication to the company's mission. Many of the legacy HR policies and procedures date back to the early 1980s and beyond, and in some cases have fairly little relevance to high functioning electric distribution utilities. The longest serving HR Department staff are usually those knowing almost all rules and how and where to find them. Staff particularly from outside the this department are therefore considerably disadvantaged, being dependent on the HR Department even for minor matters eg. leave sanctions etc. In such a scenario, transparent and equitable HR operations cannot occur. Where policies or procedures do exist, there is inadequate implementation, creating scope for interference both internal and external.

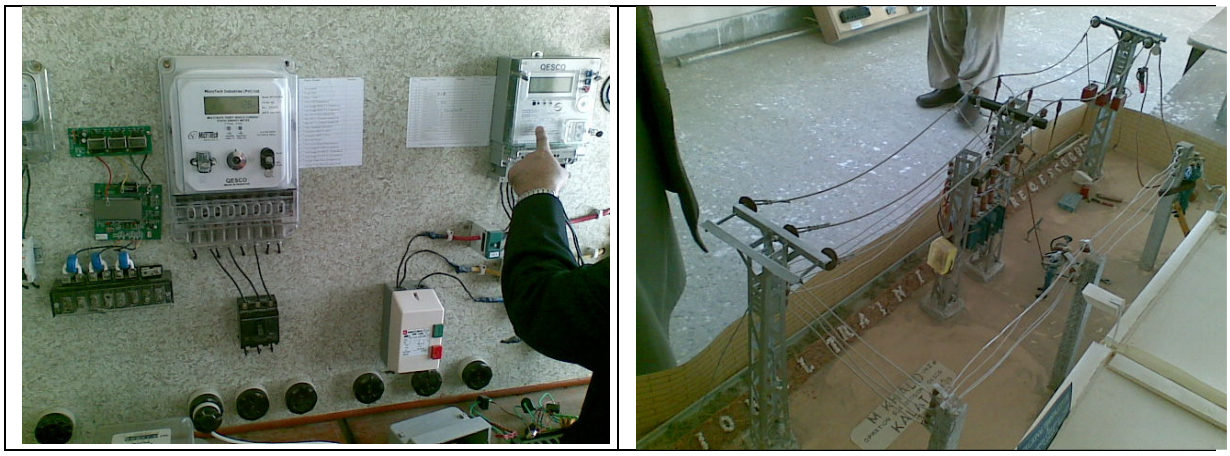
Employee Handbook

As mentioned earlier, QESCO has yet to develop an Employee Handbook, a concise document providing essential guidance on employee policies and procedures – the Do's and Don'ts to help guide them. Ideally such a handbook should be accessible/available on the web, in booklet form and in both English and Urdu.

Training and Capacity Building

QESCO, like other DISCOs, lacks a culture that fosters learning and knowledge. It has not yet developed training programs addressing QESCO-wide training needs to upgrade and retain its human capital. This DISCO has the best training facility that the PDIP team visited in all the

DISCOs. The images shown below documents the fact that the QESCO RTC has maintained its facility in good condition, and that this effort deserves appreciation.



However, there is a need to reactivate the CTC's in QESCO as these do not currently function. Additionally, the instructors themselves have not been trained in many years, and the training manuals have not been updated in over more two decades. The training program also lacks a component for post training impact evaluation. After retrieving data and relevant information for capability building programs within this DISCO, following are the most urgent functional training needs identified by the PDIP-HR team and the relevant staff to be trained theron:

Commercial Training

1. Customer Information System (CIS): Deputy Managers, Managers and the Director Commercial Department.
2. Customer Care. All commercial staff. shall be participants of this training program
3. Energy Accounting. Deputy Managers, Managers and the Director Commercial shall be the participants of this program.
4. Meter Reading and Optimization. Metering staff shall be trained on this module.
5. Electronic Meters. All Commercial Deputy managers & Managers shall attend this training.
6. Billing Process and Calculation. Billing commercial staff shall be benefited.
7. AMR Metering Systems. The Deputy Manager and Manager Commercial Department shall be trained in this program.
8. Basic IT Skills for Commercial Staff. All Commercial Staff.

Engineering & Operations training:

1. Distribution Planning & Management. Target Audience: Senior Engineers, Chief Engineers.
2. Distribution System Design: Planning Engineers
3. Loss Reduction Techniques. Engineers, Senior Engineers.
4. Modern Power Distribution Practice. All Operation Engineers.
5. Power Engineering / Power Systems. Senior Engineers.
6. Power Engineering / Power Systems Control. Senior and Chief Engineers

7. Materials and Inventory Management. Senior, Deputy Managers.
8. Contract Management. Chief Engineers.
9. Geographical Information System. Planning Engineers.
10. Technical Report Writing. All technical management staff.
11. Supply Chain Management. Store Officers.
12. Power Sector Management Practices. Chief Engineers, Senior Engineers.

Finance & Accounting

1. ERP Accounting Information System. Target Audience: Deputy Manager, Manager Finance.
2. Project Cost/Benefit Analysis Techniques. Senior Managers Finance.
3. Financial Management Reporting. All management staff.
4. Internal Control and Audit. Audit Officers.
5. ISO 9001:2000 Certification and Standard. Senior Managers.
6. Business Plan Development. Directors and Senior Managers.
7. Tariff Development. Directors and Senior Managers.

Human Resource Management

1. Introduction to Human Resource Information System. Target Audience: All HR management staff/ non management staff of HRIS Section.
2. Employees' Orientation and Motivation. All HR management staff.
3. Employees' Relation Management. Managers Legal and Litigation.
4. Workplace Law and Grievance Handling. Deputy Managers and Legal Officer.
5. How to Manage Learning Centers (Training Centers). All Training Center Managers.
6. Effective Communication Skills. All HR management staff.
7. Basic Computer Competency. HR management & non management staff.
8. Annual Performance Evaluation. Performance Management and Career DevelopmentOfficers of HR Department.

Communications and Outreach Assessment

Overview

QESCO is a unique distribution company among the DISCOs as it covers almost the entire province of Balochistan, about 43 % of Pakistan's total area, except Lasbela district which is served by KESC. Concurrently and ironically it has the smallest number of consumers among all DISCOs in Pakistan; it serves a rural clientele with dispersed population. With a network of 42 operational subdivisions, 11 divisions and 3 circle offices, the utility serves approximately 491,000 consumers. As a corporate entity, it stands at a crucial transition point. Despite making considerable efforts to assume the role

of a service-delivery organization, it continues to face countless problems, including the growing electricity demand-supply gap.

QESCO has a Public Relations (PR) department responsible for dealing with the media for coverage of the company's events, besides issuing notices and press releases. The power-shortage and outage, elimination of subsidies, and unprecedented frequent tariff increase have posed serious challenges to the utility in the past few years. As a result, the company is struggling to earn consumer confidence and satisfaction. Lack of consumer confidence in the utility further erodes its corporate image. In this context, the role of a well-thought out and well-designed communications and outreach campaign to foster a progressive corporate culture, as well as its efficient and timely implementation, cannot be overlooked.

This section analyzes the context of internal, external and corporate communications; as well as related capabilities within QESCO, and provides recommendations for priority areas.

Summary of Key Findings

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

- **Internal Protocols and Practices:** In internal communication, the outdated and rigid practices of manual file culture are still in place. The use of computers and modern communications tools is also very low. This hampers the process of transition to a modern service delivery organization with a positive corporate image and progressive growth.

- **Corporate Communications and Consumer Outreach:** The external communications and outreach involve only a few isolated activities by the company. Due to the absence of a comprehensive strategy in these areas, QESCO has not been successful in building a corporate image or winning the confidence of its customers.

- **Public Relations Department:** The activities carried out by the PR department are limited to media monitoring and liaison for corporate information. Owing to the lack of decision-making autonomy and limited budget availability, it is not easy for the PR department to execute any mass awareness campaigns. As such, QESCO only undertakes external communication at the local media level, and that too in a very limited capacity.

- **IT Penetration:** Very limited presence and usage of computers and modern communication tools is an important challenge faced by QESCO. Due to low IT penetration and skill deficit in the management, the orthodox culture of files and memos is still in place. Usage of modern communications technology and across-the-board training for such tools is imperative for a corporate shift and more efficient, timely and clear communication.

- **Media Mix and Products:** QESCO does not use an effective mix of media tools and products. Its outreach activities remain limited to issuance of press releases, shutdown & procurement notices, and the occasional energy conservation awareness messages through the local print media. The website is outdated, not well-maintained and does not portray a corporate image. An annual calendar, for both internal and external activities, has also not been developed.

- **Customer-Centric Communications:** The customer services centers which serve as the face of QESCO by providing direct interaction points with consumers are neither customer-centric nor gender friendly. They are operated by mostly *ad-hoc* staff which substitute at these centers and have no training in handling customers or their complaints. Complaint records are handled manually and there is no digitization for fast, efficient response.

- **Consumer Education and Awareness:** Consumers in QESCO's service area are neither very organized nor aware, and are usually aggressive and hostile regarding increasing electricity prices and frequent shutdowns.

Analysis and Discussion

QESCO serves a large consumer base spread out in the province through 42 subdivisions. With this extensive service area and customer coverage, both internal and external communications are challenging. The task assumes more significance as its communications and outreach practices are classically public sector oriented; relying on rigid protocols and ingrained resistance to modernization of operations.

Despite all these limitations, QESCO's leadership is aware of the potential role of communications and consumer outreach. There is considerable will to adopt new technological means towards these ends. However, the company faces critical challenges of entrenched practices of outdated information sharing that inevitably push the role of modern communications to the periphery. Moreover, despite being mandated as an independent distribution company, the utility continues to derive much of its management and communications authority from PEPCO and MWP, which further constrains its ability to independently control its mass media campaigns.

With due affirmation of the above-mentioned constraints, the communications and outreach assessment was conducted to review the efficiency and effectiveness of QESCO's internal and external communications. The results are discussed as under.

Internal Communication Process, Protocols and Practices
Internal communication is public sector oriented. Hand delivery of letters, circular notices, departmental meeting notes and inter-office memos is the usual mode of internal communication. Methods for communication within or outside the city include normal post, fax or special messengers. The audit requirements and litigations further reinforce this traditional, file-driven communications culture.

The presence of computers was found to be minimal. Not more than 150 computer terminals are available in the entire DISCO. Moreover, the sanctioned staff strength was determined decades ago when computer technology was not current. Despite changes in technology and typewriters becoming obsolete, similar patterns are perpetuated, the typists having become the managers' personal assistants. It was reported that the majority of the staff have not been re-trained in computer skills. According to one top QESCO official, "*We have simply replaced the old typewriters with computers for preparing official letters and memos."* This indicates that computers are provided and utilized but not to their maximum potential, resulting in minimal benefit.

An Information Management System comprising a reliable database of employees, rules and regulations is not available for ready reference and access by field staff and head-office employees. This forces staff to rely on the archaic and inefficient communication patterns described earlier. Usage of modern communications technology and across-the-board training for such tools has been identified as imperative for the corporate shift to efficient, prompt and clear communication.

There are few internal activities for employees, mainly related to staff gatherings on certain special occasions, usually to bid farewell to retiring employees or participate in staff welfare-related events. No other activities have been reported such as ecommemorations, seminars, family gatherings, staff functions, etc.

The Public Relations Department
The PR Department at QESCO is the focal point for external communications and outreach activities. It is supposed to be a line department of the HR & Admin. However it functions directly

under the CEO's office. Moreover, the PR Department is not reflected in the company's organizational chart.

The department is headed by a Deputy Manager and assisted by two staff members - a computer operator and a clerk. An assistant lineman is currently performing the role of official photographer. The Head of the PR department is actually an electrical engineer working as Deputy Manager Operations & Maintenance. In addition to his actual functions as an engineer, he has the additional charge of the PR Department since 2008.

Having no specialized training or qualification in communications and outreach, the Deputy Manager is handling the functions of this department through 'personal skill and understanding.' There is one computer terminal – connected with broadband internet – one fax machine, one telephone, and one television set to monitor the electronic media. The Department's main task is liaising with the media and monitoring media reports. It is also mandated to focus on external communications. This department has minimal interaction with other departments.

Main functions of the PR department include:

1. To scan three national and eight regional newspapers on a daily basis and prepare a summary for the CEO. The department also receives complementary copies of more than forty local weeklies and dailies.
2. To prepare and issue press releases on QESCO activities, public notices, procurement notices, shutdown announcements, etc.
3. To liaise with the local press and electronic media for corporate coverage.
4. To respond to any adverse media query appearing on TV channels or in the press.
5. To keep liaison with PEPCO for corporate and external communication activities, media queries, preparation of new media campaigns, and press issues relating to the Press Information Department (PID).
6. To liaise with the designated advertising agency for preparation of press/electronic media campaigns and media responses.
7. To manage the compilation and publication of the quarterly newsletter, projecting corporate activities.
8. To liaise with local printing presses/production houses to manage the printing jobs.
9. To liaise with other departments to collect information material and manage printing of the Annual Report.
10. To arrange outreach activities including seminars, events, radio talk shows and press briefings on corporate and electricity-related issues.

The PR Process and Practices

QESCO undertakes the external communication at local media level. The PR department liaises with the local media for corporate coverage and handles bad press. The main communication activities of QESCO are press releases, monthly newsletter, shut down announcements and procurement (tender) notices. Main outreach activities include occasional seminars on energy conservation, press talk shows, and events management.

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 noteworthy activities to organize independent mass media coverage.

Review of Outreach Campaigns and Media Mix

The PR department creates and manages media coverage to highlight information such as power shut downs, or promote energy conservation issues. Public service announcements such as load-shedding schedule, sabotage of QESCO network, etc., have also been made through tickers on cable television. However, the level and frequency of this type of communication and media outreach is not significant to make a noteworthy impact in the media. No calendar of media campaigns and activities is prepared as part of a corporate communications and outreach strategy.

According to the QESCO Annual Report 2008-09, the organization extends full cooperation to the media and interacts with it regularly. Being the focal point of the DISCO, the CEO regularly conducts press conferences and 'meet the press' events at the local press club.

Occasional participation of the CEO in television talk shows related to QESCO's activities, customer services and energy conservation was also observed. A few posters related to safety and energy conservation have been printed during the last few years.

External Communications and Outreach Strategies

As the electricity demand-supply gap widens, it becomes critical for QESCO to provide reliable and timely information to its consumers. As already noted, an indisciplined, hostile and aggressive consumer culture is adding to the utility's problems, to the extent that sabotaging of QESCO's network by miscreants is a regular occurrence. As a priority, promoting its role to the public requires the building of consumer perception and trust in the company's ability to serve its extensive territory. However, as observed QESCO's external communication is not proactive, its outreach activities being ad-hoc and infrequent have not made an impact to earn consumer's mind share.

Customer Complaint Centers and State of Communication with Consumers

QESCO has one complaint center i.e. the Minister's Complaint Cell (or QESCO Complaints Cell) located at its headquarter in Quetta. The cell entertains complaints relating to erroneous meter readings, feeder shutdowns, requests for duplicate bills, and issuance of bills to corporate customers such as telecom companies.

Similarly, a centrally located Customer Service Center has also been established at Liaquat Bazar, Quetta. It was observed that this center is no longer easily accessible to customers due to security barriers erected following a bomb blast in the vicinity. Furthermore the staff handling complaints is not exclusively trained in customer handling or etiquettes of customer-centric communication.

Records of complaints are maintained manually. Monthly record of complaints is prepared and sent to the Customer Services Department for reference and record. The manual data of these complaints could be digitized for maintaining a convenient database and facilitating subsequent data-analysis for better customer service. It was observed that modernizing the existing customer handling services; and establishment of well-equipped customer service centers at the grass roots level - with dedicated and trained staff, and online connectivity - could help create a more efficient and customer friendly environment for QESCO.

Customer complaint centers do not have sufficient informative material such as posters, brochures and flyers, explaining the process of complaint handling, and the salient points of customer service guidelines, to incoming customers.

Existing IT Culture for Communication

QESCO has yet to introduce modern technology to revolutionize its internal and external communication. About 150 computer terminals are available in the entire organization. Out of these available terminals, quite a few are operational and therefore connected with the internet. Most of the official email addresses are either non-operational or being operated by the staff of the relevant official.

The current web page is developed on html format and seems to be quite static. The MIS department updates the relevant information on the website as and when needed. There is a dire need to make the website dynamic and interactive, along with the training of managerial staff to actively contribute to better external as well as internal communications.

Ironically, in a few of subdivisions, obsolete floppy drives/discs are still in use. Nevertheless, a proposal to improve the state of technology usage has been submitted to the Power Information Technology Company by QESCO.

Customer Services and Complaint Handling with a Gender Perspective

As noted, the customer service centers are not gender-sensitive. No separate counters have been designated for women and no separate seating arrangements have been made. Though the existing Complaint Cell at the QESCO headquarter is supervised by a woman executive, the concept of dedicated female staff to deal with the complaints of female customers has not yet been introduced. Similarly, no separate washrooms are available for women complainants.

3. CONCLUSIONS

3.1 Governance

QESCO's Board of Directors does not function effectively as a corporate board. For one thing, the CEO, appointed by PEPCO and not hired by the Board, is a Board Mmember. The BOD should look into the formation of various Board Committees as practiced by other DISCOS of the country, and the appointment of a full time Company Secretary. The newly reconstituted Board will need both governance and electric utility training. Its newly defined Directors will require training to prepare them for the challenge of governing QESCO in the changing utility environment in Pakistan, and to advise Board Members of their roles and responsibilities vis-à-vis the MWP, NEPRA, and other stakeholders in the power sector. The Internal Audit Department should report directly to the BOD Audit Committee.

The BOD should be formally established as the DISCO's independent governing body with ultimate decision-making authority and be 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 if called for fire the Managing Director and senior executives (5) determine and pay the dividend and (6) issue additional shares.

Engineering

The engineering results section of this report presented the process whereby the PDIP engineering team prepared an evaluation of QESCO's distribution management system, and the results of a mapping and loss assessment effort. This section will present the conclusions of the team resulting from their observations and calculations,and recommendations regarding opportunities for improvement.

Transmission Network

The PDIP team did not carry out any specific analyses of the transmission network, but the level of losses indicates that transmission issues are of primary importance to QESCO. In particular, reactive power control will be important to maximize the available capacity. Additionally, there is a need to improve the voltage profile at the 220KV substations. Data provided to the PDIP team has shown that the maximum and minimum voltage at 220 KV Sibbi and 220kV Quetta Industrial range from 218/137-200/127kV and 200/127-178/113kV respectively. Similarly, the power factor at the 2 power sources (Habibullah Coastal and Thermal Power Station Sheikh Manda) range from 0.73 to 0.91. Therefore, there is an urgent need to improve the voltage situation in QESCO.

Planning Processes

QESCO's planning management does not appreciate 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 compared to what has already been expended on the existing system. QESCO could therefore have a fully up-to-date mapping and analysis system at a low cost. The utility at present has no staff resources capable of using a new system.

Standards and Specifications
The updating of standards and specifications is handled by NTDC's Design and Standards Section. WAPDA construction standards have generally served QESCO 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 Quetta 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. QESCO 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 QESCO fails to take advantage of the principal opportunity for reducing the costs of materials, and that is the economies of scale. The DISCO 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 as per legacy WAPDA practice, largely diluting the benefits that could be obtained. When WAPDA was a government agency, this was necessary to ensure that all vendors received some portion of the orders, but now that QESCO is corporatized it is less appropriate. The need to handle such a large number of solicitations also introduces a considerable overhead burden on the utility.

A byproduct of breaking the procurements into small parts is to discourage international suppliers who can often source material from a number of countries and offer better pricing and higher quality. Again, this may have been appropriate when WAPDA was a government agency and it was considered 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 QESCO's needs for materials could be satisfied by 8-10 procurements a year, two each for poles, hardware and accessories, cable and conductors, and transformers. Special purpose solicitations may be necessary for turnkey items such as substations, but even these should be few and large. It may even be possible for sharing of procurements between DISCOS, allowing for increasing the size of procurements to levels that would be definitely attractive to international vendors.

Another observation is that the Procurement Division does not appear 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 QESCO is carried out almost entirely by around 70 to 80 locally prequalified contractors, only emergency maintenance works implemented by the utility's own construction staff. M/S Barqab as a Consultant verifies construction work. Construction quality in general is acceptable, with some reservations. The PDIP team determined that QESCO's Construction Department, responsible for quality control, neither carries out this function nor documents it. The department is self-policing, ie. with no cadre of construction inspectors or any system for contracting this activity externally. As a consequence it is difficult to ensure quality of work.

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 QESCO construction cadres did use connectors, but no new installations have them. All joints appear to be made with wrapped or "served" aluminum strands. No matter how neatly this is done, it is bad practice and will result in 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 QESCO are responsible for many elements, but amongst the most prioritized are commercial operations such as meter installation, meter reading, disconnection of defaulters, and continuity of service tasks eg. repairing faults.

The PDIP engineering team found that at the subdivisions procedures exist for almost all tasks, but that staff was lethargic in their compliance, particularly with such record keeping tasks as measurement of transformer loading and rebalancing.

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

In addition, safety emphasis is minimal with no recurrent training, no safety meetings, and no 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. Innovative power thieves have succeeded in violating these meters, but there is no question that they are

more resistant to tampering than the older electromechanical meters. However, the primary threat to meter security is not the meter itself, but continues to be the service drop and the connections to the meter which are completely unsecured, as well as the LT network which is still composed of bare conductors. QESCO 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 large existing fleet of electromechanical meters still in service in the system. These meters were in most cases not highly accurate to begin with, and age has not improved their performance. They have not been calibrated since installation, and while it is certainly in the utility's long term interest to replace them, to the extent that they can be brought to a reasonable level of accuracy through inspection / 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 QESCO 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 QESCO were found to be 10.5%, broken down as follows:

- Conductor Loss 7.45%
- Transformer Loss 2.7%
- LT Network Loss 0.2%
- Service drops 0.2%

This level of technical loss can be compared to the total distribution network loss of approximately 13.9%, indicating that commercial losses are in the order of 3.4%. This shows that QESCO's major challenge in loss reduction is in both technical as well as commercial loss.

Opportunities in Loss Reduction
The opportunities for loss reduction in QESCO 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 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
QESCO's average feeder length is almost 46km, which means 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.
- *Reactive Power Control.* This is the use of capacitors and reactors to compensate voltage drops on transmission networks, and would not only reduce losses but provide better control of source voltage. The most significant beneficiary of reactive power control will be the service to the Quetta City area, which must now suffer load shedding even when adequate generation resources are available.
- *Selective reconductoring.* The majority of the high conductor loss is to be found in the first 10% of feeder length, where the load is heaviest. Replacement of the commonly used Dog conductor with Osprey would reduce losses by 50% in these segments of line, without the need for bifurcation or addition of new breaker positions.
- *Development of improved transformer specifications.* This would dramatically reduce transformer losses. Transformer losses reflect 26% of QESCO's overall technical loss, and technologies exist to cut even the current new specification losses substantially.
- *Review of long feeders (over 63km in total length) o*n the basis of voltage drop rather than thermal capacity. The current method of identifying problems only when conductor loading exceeds 300 amps is inappropriate for long rural lines. These circuits have already entered into voltage problems and high losses long before reaching the 300amp threshold.
- *Application of compression connectors for most taps and other joints.* So as to eliminate jumper burnouts. Points at which sectionalizing is done would be retrofitted with bolt-on connectors to facilitate disconnection. Replacement of wrapped joints would reduce callouts for jumper failures and improve service quality, though the impact on losses would be small.

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 as the installation has no security at all. Neutral concentric

cable encloses the cable in a grounded sheath so that any attempt to penetrate the cable with a sharp item such as a nail or an awl will cause a short circuit and defeat the attempt at penetration.

- *Investigate the use of socket type meters.* Which provide greater security for meter connections, and have larger high current connections, allowing them to be applied for direct reading up to 320 amps. This would reduce the number of CT type meters that have to be installed, removing the CT accuracy as an issue.
- *Replace most of the current stock of CTs in use in industrial metering boxes with either direct reading meters or higher quality CTs.* There have been a number of instances of CT failure, which of course compromises the meter reading.
- *Work with meter manufacturers to improve the security of indirect meters (CT and CT/PT installations).* The current crop of electronic indirect meters can be reprogrammed from an optical port to alter the meter multiplier. This creates a vulnerability to any person with the correct software and the optical programming wand, all of which can be obtained at low cost in various markets.

Financial Management

As noted QESCO collections are reportedly at 77% for private consumer energy sales, and at 60.8% for government clients in FY 2010. Given the DISCO's role as a quasi government agency, it has proven impossible for it to treat government clients on a par with commercial consumers.

As reported in the results chapter of this report, QESCO has an arrangement with the banking system and other local payment centers to collect funds from its consumers. This arrangement must ensure that collections are managed effectively and relatively efficiently. However, there are two issues with this collection system. Firstly, many collection points – including some banks – retain customer payments to QESCO 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 55% of cash receipts are received on the same day they are paid to pay points at the QESCO principal bank account. Approximately 30% of cash receipts are received through offline banking transactions which involve a 2-3 day delay in getting to QESCO's account. The remaining 15% are receipts from post offices which may take a week. Remittance of these funds from QESCO to the CPPA in payment of purchased power is important, and creates a significant loss from the perspective of the CPPA.

QESCO's desire to implement an ERP solution will provide the means to integrate business, human resources, engineering, asset management, workplan management, and operations into an electronic environment that can be used real time in all phases of QESCO operations. Enterprise systems offer the opportunity to convert manual business and distribution operating systems to electronic, computerized management systems. This will be important as QESCO transitions into customer information and billing systems, geographical information systems (GIS) and other applications.

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

QESCO needs to expand and enhance internal audit practice and procedures that were established in 1985, and have not been updated since. The archaic WAPDA audit manual is too narrow in scope to effectively audit QESCO 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 which states: " the 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 that the defects and irregularities noticed in such accounts/ books are rectified as far as possible.." At present, the internal audit functions only as a limited review of certain transaction based activities rather than carrying out full reviews of internal control systems.

The QESCO Accounting Manual has not been revised since 1985; as with the Audit Manual, there is an immediate need to revise, update and improve this document especially once NEPRA defines the chart of accounts, to comply with its requirements.

There were a number of examples of government involvement noted which constrained and hampered the operations of QESCO. 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 appointment to certain new positions.
- The receivable amount from both the Provincial and Federal Governments on account of agricultural and tariff differential subsidy has increased substantially. This major amount of receivable has seriously affected QESCO's position as a viable entity.
- 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. An onerous and time-consuming process.

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

Finance and Accounting Recommendations

- QESCO should hire a Consultant to revise and update Accounting and Internal Audit Manuals in line with the movement to modernize the utility, 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.

1. Evaluate means of improving transfers from pay points to QESCO bank accounts.
2. Initiate and complete 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 QESCO Board of Directors, NEPRA, and MWP as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization.
3. There is need for a ten year financial forecast model to assist in the preparation of QESCO's Business Plans.
4. Effective followup for the early resolution of the major amounts receivable from GOB, Tariff Differential Subsidy, and GST.

5. Obtain insurance coverage for buildings, equipment, inventories and such other assets as deemed necessary, to eliminate exposure to significant financial loss.

An observation of the PDIP team is that QESCO 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 QESCO is through International Donor Agencies. Often the proceeds of loans by the Kuwait Fund 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 negative 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 reliably fulfil its obligations to its consumers and function as a true corporate entity.

Commercial Management

Commercial policies are defined in a logical fashion, but not effectively practiced. Moreover, these policies and procedures have not kept pace with changes in technology; rather than using electronic data collection and transfer, QESCO relies on manual recording, transcription, and data transfer processes. The utility is slightly behind its sister DISCOs in technology adoption and automation, as evidenced by the fact that there are no level-1 divisions in QESCO, requiring all data entry to be done at the Computer Centers. Field staff has to rely on computer centers to provide MIS reports, which are either delayed or not delivered.. This system must be changed at the earliest to electronic data collection and processing, reducing the potential for manual adjustments/interventions that diminish commercial integrity.

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

As mentioned earlier in this chapter, there is an urgent need to introduce more modern, advanced technology into QESCO's commercial management. Use of automated meter reading (AMR) meters; prepayment metering technology; handheld meter reading technology, and other advanced communication and metering technology would eliminate reading/transcription errors, and reduce vulnerability to employee/consumer manipulation of metering data. Use of AMR meters on industrial clients and transformers would make energy accounting more readily available, and also facilitate 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, but also to review the meter reading auditing checked by the SDO and XEN. QESCO management and staff readily stated that these practices are not followed as required by policy owing to the extraordinarily large service territory, inaccessibility of certain areas due to weather/law and order situation, and inordinately long travel times. Since all three circle offices are situated in Quetta City, keeping track of far off division/subdivision offices is difficult.

Without an objective and periodic review of meter reader performance, meter reading personnel can (and reportedly do) manipulate consumption data for the purpose of increased revenues by taking advantage of the slab tariff structure. Over a period of a few months the readings can be corrected to

actual, but the revenue is not adjusted for the over-billing. Because auditing procedures are not followed, collusion between employees and selected consumers will not be detected.

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

Billing cycle and energy accounting

Streamlining the billing cycle will result in financial benefits to QESCO and/or CPPA. Improving cycle efficiency will result in accelerating collections, allowing the utility to generate short-term interest dividends, or CPPA to reduce interest and penalty charges that may accrue from delays in payment to generation companies. However, substantial benefit from cash acceleration can only be acheived if agricultural consumers pay for their consumption.

QESCO 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 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 QESCO 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

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

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

Recommendations

In order to achieve improved commercial performance, a number of interventions will be required that are related to one another. Improvements in metering technology from 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 data manipulation. Implementation of a

CIS will require new accounting, data collection/transfer, and billing procedures. Best practices require that a consumer census be taken to populate the CIS database with accurate information.

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

1. Consumer census, to verify/add consumer data, should be carried out.
2. Installation of a CIS should be implemented.
3. QESCO's corporate structure should be reorganized so that all commercial units report to the Director Consumer Services.
4. Implement a metering program in conjunction with the Government of Balouchistan so that the tubewell consumers can be metered effectively and the metering is mutually accepted by both QESCO and the subsidy providers.
5. Metering should be updated using advanced metering technology where appropriate, and use of meters on selected distribution transformers evaluated.
6. Meter routes should be reorganized.
7. Energy accounting should be implemented.
8. More comprehensive customer service and consumer awareness programs should be designed.
9. Meter reading audits and meter inspection programs should be enforced, possibly by outsourcing. the tasks
10. Systematic meter repair, testing, and calibration should be established.
11. QESCO operates through three circles, all located in Quetta City. Customer outreach and oversight on field offices is very weak.The southern circle alone covers more than 60% of the geographic area. A circle office with the capacity to run all commercial, operational and IT functions should be established outside of Quetta City. The port city of Gwadar is a potential candidate because of its accessibility, better law and order situation, and future growth potential.
12. The hub and spoke concept should be introduced to streamline commercial operations in remote field offices using technology. With minimal IT hardware/software/training, field offices can run fully automated commercial functions such as connection services, data entry, bill printing, payments, reconciliations etc. Applications would be accessed online using telecom infrastructure.
13. Automated metering at feeder, intermediate points on 11KV line, and distribution transformers should be introduced, with real time reconciliation for energy accounting and theft checks.
14. Village level authority structures should be introduced to encourage energy management oversight and discourage tampering. The village committee can train one farmer as part-time electrician to maintain power supply infrastructure and also collect user charges.
15. Prepaid meters should be introduced. This will minimize electricity and water wastage as farmer will see on their meters how expensive it is costs to pump groundwater.
16. Three stage distribution system should be introduced where 1000V branches are taken from 11KV line and a small 11KV/0.4V transformer is used to connect few customers, metered directly at transformer secondary. This will control illegal taps on low voltage lines and extending services will be more cost effective.
17. Separating agricultural and non-agricultural feeders should be considered, with supply rationing to control unabated usage of electricity.

Human Resource

HR policies and procedures have remained stagnant for the past two to three decades, and currently do not support QESCO's needs to attract and retain highly skilled, dedicated, and engaged employees. Staff at all levels has repeatedly stressed the need for change and intervention in this area.

While some capital investment will be required, the Team feels that substantial investment in time is essential. It need to be established that QESCO is fully involved in the development of policies and procedures, so that changes are readily accepted.

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

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

Increasing the salary at par with market levels will per se change the work ethic and culture. There will be a need to actively engage employees in a new relationship/recognition re. QESCO management and board priorities; whereby all personnel are aware of, appreciate and accept the new corporate culture, and where positive performance becomes a clear criterion for recognition.

Recommendations

1. Develop performance management program, together with revised descriptions, and setting of goals/objectives for all positions; and establish mid-year and annual evaluation review process, measuring employee performance, and issuing rewards based on performance.

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

3. Revise the compensation and benefits system 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 package is offered only to those employees opting for the new terms and conditions of employment, including performance, etc.

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

5. Build further on the existing Human Resource Information Management System (HRIS) to enhance data and reporting capability, as well as the level of IT in the training facilities.

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

7. Evaluate staffing levels vis-à-vis international best practices. Develop staffing plan to reduce levels in conjunction with outsourcing and reduction through attrition program. A review of the total work force shows that a large number of employees are engaged 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 line staff employees. Ensure that linemen are provided with and required to use proper clothing and safety gear while performing construction and maintenance tasks. It will be the DISCO's social responsibility to ensure that the safety message is extended to the public / customers, through an outreach program.

Communications and Outreach

The existing practices of internal communications and outreach at QESCO are mostly traditional and bureaucratically styled, relying on orthodox tools of communication. Furthermore, a mindset of restricted information sharing and resistance to technological advancement prevails. However the senior and middle management, particularly the IT staff was found to be aware of the challenges, with a definite desire to adopt contemporary practices if the business environment allowed doing so.

An integrated plan is required to change the existing traditional mindset and tools of communication. The following recommendations are outlined:

- QESCO needs an integrated communications strategy outlining key objectives, communication tools, and target audience along with a comprehensive action plan and proposed budget, to plan and improve the company's external and corporate communications.

- The PR Department should be restructured into a well-positioned and well-recognized 'Communications and Outreach Department', spearheading QESCO's internal and external communications with stakeholders and consumers and

- QESCO need to build it corporate image building through branding and showcasing success stories. An Annual Calendar of promotions and 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.

- Gradual penetration of information and communications technology at QESCO should be planned, ensuring that all managerial staff is provided desktop or laptop computers. Staff should be imparted training on basic IT skills and mandated to use e-mail as a prime communications tool.

- The utility should promote and encourage the development of information management through Intranet (database for multiple types of information) and make it accessible to all managerial staff. The data may include information on engineering, operations, customer service, rules and regulations, and employees. Successful and early implementation of Intranet can help ensure ERP-readiness among staff. Once the database is developed and a mechanism for regular updating in place, the access of information to different managerial levels may be decided as per

job requirements. Managerial staff should be encouraged to use the database, discarding the current practice of extracting routine data through laborious inter-departmental communication.

- The existing Customer Service Centers should be upgraded and re-vamped. A few model centers with a corporate outlook (standardized layout, signage) should be established in select locations and then replicated by upgrading the remaining centers.

- Dedicated and trained staff should be deputed to the Customer Service Centers to depart from the current practice of depending mainly on field duty staff. Gender-sensitivity in such centers must be ensured by providing separate windows wherever possible, along with separate seating arrangement and public utility services, for incoming women to lodge their complaints. Female staff should be recruited in the dedicated work force at circle level customer service centers.

- QESCO should promote a coherent corporate brand, and develop standard templates for stationery, file folders, visiting cards, publications etc.

- The company's web page must be upgraded for more comprehensive content display. The website should be made interactive and updated regularly. A fortnightly or monthly e-newsletter must be developed to keep its customers aware of QESCO's activities.

- Outreach activities should include the active engagement of various groups of consumers e.g. industrial, agricultural, commercial and domestic to create awareness of QESCO's functions, and promote dialogue on issues of tariff, safety, electricity theft, energy conservation etc. Awareness material for consumers may include: brochures, flyers, handouts, posters, guidelines for complaint redress mechanism; handbook on energy conservation; consumer safety manual, etc. Such material must be placed and displayed at all Customer Service Centers as well as distributed among consumers free-of-cost.

- Training should be conducted for building and improving soft communications skills, with due emphasis on gender-sensitivity (wherever required) including business communication, interpersonal communication, reporting techniques, and corporate relations. Training must also cover customer service etiquette and complaint handling skills for the CS Centers' staff.

APPENDIX: AUDIT METHODOLOGY

A.1 Overview of Data Collection and Process Assessment

The Operational PDIP Audit process was designed to facilitate data collection and to evaluate engineering, financial, commercial and human resource information & data, in collaboration with DISCO management. The objective of this activity was to evaluate performance efficiency by means of performance and process analyses, and by collecting information through one-on-one interviews with management and employees. The PDIP team also reviewed and evaluated management practices and processes. A key performance process for all electric distribution utilities involves the commercial cycle – the means by which meters are read, bills processed and delivered, revenues collected, and delinquency notices delivered. For an accurate measurement of commercial, financial, administrative and technical performance, review of key practices such as the revenue collection cycle is extremely important.

The Operational Audit for the DISCO's followed an identical process to audits undertaken in the other seven DISCOs. The process collected and evaluated data for four areas of electric distribution operations, comprising:

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

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

A.2 Governance

In addition to reviewing DISCO operational activities, the PDIP team examined QESCO's 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 was essential to evaluate the changes that would be needed to better support board composition, qualifications, training, and other characteristics.

Towards this end, the PDIP team reviewed the following documents and carried out the following analyses:

1. DISCO by-laws that establish board selection processes, scope of authority, and overall board responsibilities.

2. Board policy and procedures manual, if available.

3. Board composition, focusing on the issues of ensuring independent governance and adequate local representation.

4. Board Member appointment process, terms and tenure, and process of removal (if warranted).

5. Board Member qualification requirements.

6. Training/orientation provisions for new Board Members.

7. Periodicity of Board meetings, including provisions for extraordinary meetings.

8. Board Member fee structure – are Members reasonably compensated for their participation?

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

A.3 Organizational Assessment

The PDIP team reviewed the management and organizational structure of each DISCO with the goal of assessing institutional capacity to effectively manage its human resources, physical assets, and business systems. The review included the following evaluations/analyses of organizational/managerial issues:

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

A.4 Engineering Operational Audit

The engineering assessment reviewed four components:

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

A.4.1 Transmission Review

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

A.4.2 Distribution System Management

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

Typical questions explored by the engineering team included:

- Status and currency of system maps.

- Processes used for distribution system planning.

- Methods for procurement, and adequacy & availability of materials.
- Adherence to standards in construction, and a visual review of quality of construction.
- Meter security and vulnerability to tampering.
- Operations practices and adherence to established policies and procedures.
- Adequacy of lineman safety programs and equipment.

A.4.3 Segregation of System Losses

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

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

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

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

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

- Feeders were selected by a random number process so that each had as much chance of being selected as any other, to maximise the potential that the set of feeders was truly representative of the system as a whole.
- Average feeder length of the sample population was close to the average feeder length of the overall feeder population..
- Distribution of sales in kWh/year between domestic, commercial, industrial, agricultural and other consumers for the population of sample feeders was close to that of the overall DISCO feeder population.
- The sample feeders had complete data, including total sales and feeder input data, and total length. Feeders with data anomalies were excluded.
- Total feeder length was limited to 200km, which was the length of line that the PDIP GIS team could survey in the time period allocated.

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

11kV Feeder Mapping and Analysis

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

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

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

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

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

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

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

LT Network Mapping and Analysis

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

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

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

Where:

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

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

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

Service Drop Losses

Service drop losses can be calculated on the basis of the assumption that all domestic sales used single phase meters, while all commercial and direct reading industrial sales used three phase meters. In most DISCOs, an effort was made at some point in the past to move meters to the base of the pole as opposed to being mounted on the exterior of the premise. This had the effect of shortening the effective length of the service drop from the utility's standpoint to 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.

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

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

Calculation of Energy Losses

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

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

Where:

LLF= Loss Load Factor, or the load factor of the on-peak losses
ALF= Average annual load factor for the element under consideration.
K = a constant determined by analysis of the load curve of the feeder and recognizing that losses vary inversely as the square of load.

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

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

A4.4 Distribution Standards

The fourth and final component, which was applicable to all DISCOs but was reported only for LESCO, consisted of a series of interviews with staff at the Distribution Standards group of the NTDC. 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 beginning the Operational Audits, key financial parameters were identified for inclusion in the data collection and analysis process. The financial performance parameters that were evaluated include: financial reporting, internal control, cash receipts and disbursements, operational financing, and investments & cost containment.

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

DISCO practices and procedures were evaluated for financial performance parameters. Variance between industry practice and DISCO performance was noted and reported. Procedures were used to test each financial control as a means of verifying the control mechanisms, and 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 this DISCO to ensure that all team members gained the experience and understanding of the assessment process, and to adjust the audit process for later DISCO audit processes.

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

Tools

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

Analyses

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

Presentation of Results

- Analysis of cash receipts and disbursements.
- Operational financing.
- Internal control.

- Cost containment.
- Financial reporting, with financial performance indicators.

A.6 Commercial Management Audit

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

Data Collection

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

The commercial team also collected billing/collection/consumer data from the billing system. Not only did this data serve as a baseline reference to gauge future results, but was also used to provide an indication of the time taken to complete the revenue cycle. Other hard data collected during the interviews included the number of meter reading routes, the actual number of meters in a route, the 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 was complete, the commercial team evaluated the data and DISCO commercial practices/procedures to determine what changes were needed to improve their transparency, cost recovery and effectiveness. Each step and stage of the revenue process was mapped indicating the flow of documentation, when approvals were obtained, decision points for corrective action, and the interaction between departments. These maps were reviewed for redundancies, and possible internal control weakness eg. lack of segregation/reconciliation of duties. The maps were studied to determine if there was efficient flow of data, or where interventions would be helpful in reducing costs, increasing revenues, and/or accelerating cash flows.

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

A.7 Human Resource Management Audit

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

The goal of the HR management audit was to identify improvements needed in this sphere and in DISCO organizational structure to result in an HR model supporting the utility's long-term institutional needs. This model should support appropriate levels of compensation and benefits, and establish a work environment providing the incentives necessary to support a well-motivated workforce. It should likewise support emerging process-centric culture, and also be a cost delivery model for balancing quality customer service with efficient service delivery. Both these aims require DISCO organizational structure support and both are predicated on motivated and satisfied DISCO employees. The assessment therefore focused on assessing not only organizational structure and key processes, but also on 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 team reviewed and evaluated the state of HR management system, functions, responsibilities, performance management systems, and compensation package. The evaluation compared the DISCO HR management/management systems with best practices from within and beyond Pakistan, from which recommendations were made regarding how the prevailing policies, practices and procedures can be revised to enhance the productivity of each DISCO. The assessment team used diagnostic tools to identify gaps in optimal utility personnel performance. Data was collected through interviews and surveys to take a baseline of current policies and practices; this was contrasted with best practices to define the actions necessary, through the DISCO Performance Improvement Action Plans, to result in significantly improved human resource policies, practices, and management systems.

Data gathering included:

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 administration at the Division and Subdivision levels, to assess roles and responsibilities, adherence to existing utility procedures including health and safety, and any other standard operating procedures existing within the DISCOs.

Review of HR strategic and functional analysis included:

1. Assessment of company's vision, mission, goal and objectives; and their linkage with departmental goals and objectives.
2. Assessment of recruitment process.
3. Evaluation of compensation and benefits.
4. Evaluation of performance management system.

5. Evaluation of integration of corporate communications with HR communications.

Evaluation of training and capacity building needs included:

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

A.8 Communications and Outreach Audit

Communication and outreach is a direct expression of the corporate culture and values of an organization. The key areas of communication plus the processes and tools employed therein large extent, largely determine corporate priorities for internal and external stakeholders. A major feature distinguishing progressive from archaic organizations is the practice of contemporary modes of communication, assisted by scientific knowledge management and speedy decision-making.

A communication and outreach assessment was conducted for a diagnostic analysis of the DISCO's internal/external communication and outreach. The analysis was intended to provide a foundation for developing a communications and outreach strategy and action plan, towards the enhanced image and improved public opinion of the DISCO as an electricity distribution company.

The Communications Assessment included:

1. Review and analysis of existing internal/external communications and outreach strategy, organization chart of relevant departments, and job descriptions of relevant staff.
2. Review of existing and previous communication and outreach campaigns, materials, media mix, budgets, communication briefs etc.
3. Visiting customer centers/ complaint centers to obtain first-hand information on the utility's communication with consumers in terms of customer services and complaint handling style, clarity, processing time and delivery practices. These activities were also reviewed with a gender perspective.
4. Review of internal communication process & feedback /followup 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 efficacy of current communication tools/vehicles eg. websites, newsletters, emails, event management and other multilayered activities.

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

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

Internal Communication

Internal Communication is related to communications within the DISCO; between individuals, different departments, or individual and department. The assessment mapped process, feedback and followup status to gauge the existing system's suitability and efficiency.

External Communication and Outreach

The analysis of external communication determines the extent of activities carried out for corporate image building to serve as bridges between the organization and its relevant stakeholders, including extended audiences. Promotion of a strong corporate culture and a coherent brand identity through a combination of communications tools, processes, media mix, supporting budget and followups are areas that deserve careful attention.

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

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

Key Personnel Interviews:
In-depth interviews with key DISCO personnel were conducted using a semi-structured questionnaire. The questions asked were geared towards developing an understanding of existing practices, modes and means, efficiency and speed of communication, & availability of and access to information. Issues relating to 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 towards a coherent communication strategy for the company. The status and potential of outreach activities was also discussed.

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

Focus group discussion:
A focus group discussion was held with managerial staff of relevant departments to discuss the cross-cutting issues of internal and external communication on the lines mentioned above, to ascertain feedback and comments at middle management level. Topics of discussion also included the receptivity of staff to contemporary communication culture.

Documentary review:
Review and appraisal of relevant records and material available with the PR, MIS and CS Departments was undertaken, including records of daily press cuttings, press releases, & publications; practices/processes of data collection, bills printing and related output reports; and complaints registers, to evaluate the efficiency of the current systems.

Visit to the Customer Center:
The Customer Services Centre located at the DISCO Head Office was visited to understand the complaint handling process and assess the level and quality of customer service.

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