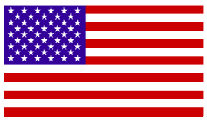

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ISLAMABAD ELECTRIC SUPPLY COMPANY (IESCO) OPERATIONAL AUDIT REPORT

Produced by:

MWP-USAID POWER DISTRIBUTION IMPROVEMENT PROGRAM

APRIL 2011

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ISLAMABAD ELECTRIC SUPPLY COMPANY (IESCO) OPERATIONAL AUDIT REPORT

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

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 In Pakistan's case however, badly outdated policies, procedures and work practices, as well as chronically low levels of investment in utility infrastructure, pose serious barriers to a successful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

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

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

Major Findings & Conclusions

The Operational Audit conducted for IESCO during Component 1 provided insights into how the utility operates and the performance consequences of its current approaches and practices. The PDIP team also became aware of deficiencies that obstruct progress towards improvement. Part of the challenge faced by IESCO'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	IESCO's governance system has not yet made the transition to a business-like electric utility. The company remains subject to political intervention, and the Board of Directors has not been empowered to oversee a true corporate entity. Recent replacement of the Board by the Government has left IESCO in a state of some uncertainty and it is hoped that the new appointments will be a positive step towards greater professionalism and operational autonomy. Additional changes will however be required to enable the Board to exert the strategic influence the utility will need to succeed in the restructured power sector in Pakistan, and to improve the company's operational and financial performance to more acceptable levels. IESCO is in the process of fulfilling all the requirements necessary for becoming a listed company. Accordingly, the Companies Ordinance of 1984 as amended, Section 204(A) requires a listed company to have a full time Company Secretary. Currently this role is being performed by the Finance Director.
ORGANIZATION	IESCO's current organization is structured primarily by geographic area and not along functional lines, the latter now seen as the most modern electric distribution utilities worldwide. Commercial units responsible for cash flows within the utility should not report to Superintending Engineers whose responsibilities focus on power system stability and reliability. The current arrangement also creates potential conflicts of interest in the performance of other key jobs within the utility.
ENGINEERING	IESCO reported loss level for 2009-10 was 9.8% whereas the preliminary loss analysis on five (5) sample feeders including one underground feeder using GIS mapping & modeling technique with load-flow software shows that the technical loss is around 13.7% which is paradoxically higher than the total reported loss. This is because IESCO has a mix of very high and extremely low loss feeders. The sample of feeders selected for survey and analysis in consultation with IESCO represents the feeders of high loss profile to identify opportunities for technical as well as non technical loss reduction. Further, the loss evaluation analysis for this study was based on the historic data of loading & energy provided by IESCO, but its findings point to a need for a more comprehensive evaluation of the IESCO's system, to identify those parts that would benefit from technical and non-technical loss reduction programs. This estimate of technical loss of 13.7% of selected feeders was not in conformity with either IESCO reported losses, or to a benchmarking technique independent of any system modeling, and so is may not be a valid estimate for overall distribution system technical loss. IESCO's revenue meter installations require immediate attention to improve installation quality, and to address significant vulnerabilities in exposed LT

	leads. A new service standard is ultimately needed to better protect the meter and the service from tampering. The underground portion of the system is in dire need of attention, particularly the LT network which suffers from damage to connection boxes, informal construction and maintenance actions and vulnerability to theft, presenting a hazard to public safety.
FINANCIAL	IESCO faces a significant financial challenge due to an ongoing dispute over power supply to the Government of Azad Jammu and Kashmir (AJK). The utility is acting as the power supplier for this territory even though the tariff for AJK sales is well below the cost of power to IESCO. Regardless of this factor AJK is refusing to pay the agreed tariff. Not only are uncollected bills accumulating, but sales to AJK due to the below cost tariff, constitute a cross subsidy by the remainder of IESCO's consumers, and affect its financial well-being. IESCO has significant financial vulnerability owing to the lack of insurance on its facilities. Grid stations and certain new vehicles are presently the only facilities covered. 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. The company'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 utility. IESCO also bears certain cost burdens rarely if ever, seen among leading utilities worldwide. As a result investment in both distribution system assets and employee equipment is hampered by low capital availability, and operating performance impacted by poor cash flows. A new, rationalized financial framework—covering both internal and external relationships and transactions—is needed to assure better bottom-line performance.
COMMERCIAL	Statistics indicate that IESCO is functioning reasonably well. However, commercial activities need improvement and transparency. The meter reading practices currently employed are subject to influence by operations management. 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. The current system of automated processing is typical of the late 1970's. Although IESCO is piloting advanced metering technologies, inadequate monitoring of all steps in the revenue cycle leaves it vulnerable to negative cash flow impacts, low customer satisfaction, and delays in completing even the simplest jobs.
HUMAN RESOURCES	IESCO's corporate culture is akin to that of a government agency in which lifetime employment with limited performance expectations is balanced by low salaries. This environment makes it difficult for the company to recruit skilled candidates for open positions because the best candidates to be attracted from the private sector industry demand higher salaries. As a consequence, it is both overstaffed by any reasonable benchmark and under-resourced, with serious shortages of employees possessing the right mix of technical training,

	experience and motivation to accomplish its mission. Moreover, the culture requires a complete overhaul to instill in all employees the strategic message that quality of work, responsiveness to customer needs, and constant attention to safety are among the company's highest values.
COMMUNICATIONS & OUTREACH	IESCO's communications and outreach practices likewise reflect the patterns of a public sector organization encumbered with laborious and conventional methods. Manual transfer of information through inter-office circulars results in lack of efficiency. The usage of Information Communications Technology (ICTs) is marginally practiced due to internal resistance to latest communications tools such as email and intranet. Public outreach is synonymous to public relations, with obsolete methods and limited ambit of liaising with the local media only. Mass media campaigning is managed by PEPCO, inhibiting IESCO's authority to build its corporate image through proactive communication with the end-consumer. The cumulative result is a chronic disconnect with the end user, lack of awareness of IESCO's service delivery role, and customer dissatisfaction.

KEY RECOMMENDATIONS

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

GOVERNANCE	The newly defined Board of Directors (BOD) should be trained to prepare for the challenge of governance in the changing utility environment in Pakistan. It should be enabled to become IESCO's corporate governing body empowered with ultimate decision-making authority to set company policy, objectives and overall direction; adopt bylaws; name members to its advisory, executive, finance and other committees; hire, monitor, evaluate and fire the CEO and senior executives;. In accordance with IESCO's intent of becoming a listed company and the provisions of the Companies Ordinance, the company should institute a full time Company Secretary position.
ORGANIZATION	A thorough review of organizational structure should be undertaken to evaluate organizational changes required to improve IESCO's technical, commercial and overall operational performance. Organization of the utility along functional lines; establishing lines of authority and responsibility through departments including General & Administration, Commercial Management, Finance, Operations & Maintenance, and Engineering & Planning should be considered. The proposed structure will allow the CEO to focus on strategic issues, leaving routine operational management to qualified senior managers.
ENGINEERING	The Operational Audit produced a large number of specific recommendations, detailed in the Recommendations section of this report. One key recommendation which promises to improve many areas of engineering performance is to develop a Geographical Information System (GIS) for the entire IESCO service territory; and to link this with engineering software to develop long-term system

	planning capability and identify loss reduction targets. In particular, the company should undertake a more detailed loss evaluation, as it was impossible to validate the stated level of losses it claimed. Another key recommendation was to undertake an immediate effort to repair and upgrade at least the LT portion of the underground system, which constitutes not only a vulnerability to theft of service, but also a public hazard.
FINANCIAL	IESCO's greatest financial vulnerability centers on its relationship with government clients. Given the un-likeliness of acquiring 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 the case of AJK, it is important that IESCO cease to be the power supplier and act simply as a transport agent for power delivered by CPPA. This will remove the financial liability of supply to this region at the prevailing tariff which does not even recover the cost of purchased power. In addition, a new financial framework is needed within IESCO and should include: 1. Updated accounting and internal audit procedures that more effectively serve the needs of the BOD. 2. Improved transfers from external pay points to IESCO bank accounts. 3. Complete implementation of the Enterprise Resource Planning (ERP) platform, and expand applications to serve all finance and accounting needs in line with control, management, and financial reporting to the BOD, National Electric Power Regulatory Authority (NEPRA), and the Ministry of Water and Power (MWP) as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization. 4. Purchase of a ten year financial forecast model and arrangement of appropriate training for business planning purposes. 5. Insurance coverage for buildings, equipment, inventories, and other assets as deemed necessary, to eliminate exposure to significant financial loss.
COMMERCIAL	A number of vulnerabilities exist in IESCO's revenue cycle requiring immediate and comprehensive attention. The key to successful electricity distribution is commercial management. If commercial practices & procedures are not carefully designed and implemented with discipline & integrity, the financial viability of the utility will be at risk. Business processes for customer service / revenue cycle should be systematically improved to increase revenue recovery, improve commercial efficiency, and enhance consumer service through: 1. A consumer census to verify/add consumers and additional information. 2. Installation of a new Customer Information System (CIS). 3. Corporate reorganization so that all commercial units report to the

	Director Consumer Services. 4. Updated metering, using automated metering technology where appropriate. 5. Reorganized and updated meter reading routes. 6. Implementation of energy accounting. 7. Design of more comprehensive customer service and consumer awareness programs. 8. Enforcement of meter reading audits and meter inspection programs. 9. Establishment of a program for systematic meter checking, testing, and replacement.
HUMAN RESOURCES	In order to foster a corporate environment and enabling healthy employment conditions, the PDIP team recommends the following changes and initiatives for IESCO: 1. A performance management program, setting goals and objectives for all staff positions. 2. An objective, transparent and unbiased recruitment process. 3. Revision of the compensation & benefits system and package, making it attractive and competitive. 4. Development of training and development programs and up gradation of current training facilities 5. Introduction of a more advanced Human Resource Information System (HRIS). 6. Revision of benefit plan, including employee health plan. 7. Evaluation of staffing levels vis-à-vis international best practices. 8. Institution of a robust lineman safety program providing structure, incentives, and assessment of housing allowances for employees residing in rural areas to attract the best resources from these areas.
COMMUNICATIONS & OUTREACH	IESCO requires a proactive communications and outreach plan to support its transition to a corporate service-delivery organization. It should: 1. Develop and execute an integrated communications and consumer outreach strategy to improve its interface with internal and external stakeholders. 2. Strengthen and restructure the PR department with financial and functional authority to spearhead a change in internal communications, corporate image building, and public outreach. 3. Realize the catalytic role of ICTs to effect an e-learning organizational culture, linking it to rewards and staff promotions. 4. Train its frontline staff (meter reader, lineman, customer service officer) in customer-oriented communications skills to act as ambassadors of IESCO. 5. Design a calendar of outreach activities, engaging consumers to build consumer trust and confidence. 6. Connect staff through an intranet facility for storing and sharing information, promoting ease of communication. 7. Develop, display and disseminate consumer information material for enhanced awareness of IESCO's role and services

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

Importance of a Strategic Plan

A strategic plan is the best way to manage complex change, overcome complacency, galvanize the organization and gradually alter course. Creating such a plan for IESCO: adopting long term goals and ensuring 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 this 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. To 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

IESCO is in an ideal position to measure its changing performance objectively to judge whether its strategies are working. As one of eight Pakistani DISCOS, the company can compare its measured performance against a group of its peers within a common industry setting. Suitable benchmarking measures may include typical bill (cost for first 500 kWh of monthly service), ratio of employees to customers served, debt-to-equity ratio, and other widely used and generally available utility statistics. Long-term targets for improvement in any area should however come from high-performing utilities of comparable size and customer mix outside Pakistan. Several utility benchmarking organizations routinely publish such data for their subscribers.

b. Critical Success Factors

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

Appropriate Use of Technology

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

It is evident that automation technology can play a major role in helping IESCO to leverage better performance. Processes can be streamlined and job tasks automated. However, the company may currently lack the organizational capability to successfully implement more advanced technologies being adopted by leading utilities elsewhere. Employees are not accustomed to learning new systems and

adapting their workflows to take full advantage of these developments.. Familiarity with computers, local area networks, and common desktop software is severely limited. Procedures accompanying technology-enabled business processes e.g. backups, and system modifications to ensure their robustness, are 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 & work practices would put IESCO's technology investments at risk; and technology projects could create problems rather than solve them.* In the short term therefore, emphasis should be on widely proven technology solutions that automate manual processes, especially in 'back-office' systems such as CIS and full build-out of ERP. More sophisticated uses of technology can come later.

Fostering a Corporate Culture that Embraces Change

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

In particular utility 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.

c. How This Report is Organized

The main body of this report is organized to highlight current challenges IESCO faces and identify actions that can be taken to address them.

- Section 1 provides essential background on the utility industry setting in Pakistan, on electric distribution companies in general, and on IESCO 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 operational performance. Key recommendations have been brought forward to focus attention and facilitate action.
- A detailed description of the PDIP audit methodology is provided in the Appendix.

1. INTRODUCTION

1.1. OVERVIEW

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

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

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

1.1.1 Background

Industry Environment

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

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

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

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

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

Challenges Faced by 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.

1.1.2 Purpose of Operational Audit and Improvement Action Plan

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

1.2 IESCO PROFILE

Islamabad Electric Supply Company (IESCO) is a wholly-owned government distribution company with headquarters located in the city of Islamabad, the Federal capital of the Islamic Republic of Pakistan. It is responsible for supply of power to Islamabad district and four adjoining districts of Punjab province namely Rawalpindi, Attock, Chakwal and Jhelum. It has boundaries adjoining GEPCO, FESCO and PESCO. The territory is spread over about 23,160 sq. km.

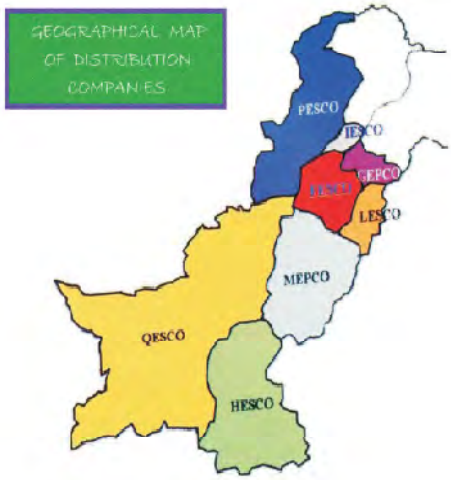


Fig. 1a: Location of DISCOs

Source: NEPRA Status of Industry Report 2009

Fig. 1b: IESCO area map

Source: IESCO Presentation at Planning Commission Website

IESCO has 5 Circles, 19 Divisions and 98 Subdivisions to manage its operations. Circles are headed by Superintending Engineers (SEs), Divisions managed by Executive Engineers (XENs) and Subdivisions run by Sub Divisional Officers (SDOs). Each division has a Customer Services Officer (CSO).

TABLE 1.1: IESCO CHARACTERISTICS

No	Description	Value
1	Administrative Districts Served	5
2	Service Area (km²)	23,160
3.	Operation Circles	5
4	Operation Divisions	19
5	Operation Sub-divisions	98

General description of market

As of 30th June 2010, IESCO reported over 2 million registered customers. Approximately 84% of these are domestic. The second largest category is commercial, comprising over 14%. Industrial customers total under 1% of all those served.

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

No.	Customer Class	Customers	Customer Mix %
1	Domestic	1,738,987	84.45
2	Commercial	298,237	14.49

3	Industrial	12,392	0.60
4	Bulk Supply	891	0.04
5	Tube wells	7,263	0.35
6	Other	1,437	0.07
	Total	**2,059,207**	**100.00**

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

Reported sales by customer class vary widely from the distribution of consumers. IESCO's primary clientele of domestic consumers account for 44% of sales whereas commercial and industrial consumers account for 12% and 22% respectively. The portion of sales from bulk supply consumers over 20%, while the contribution of agricultural consumers (tubewells) is merely 1.2%. The major portion of bulk supply (approximately 900 GWh/year) is provided to the government power authority of AJK. Table 1.3 provides a summary of sales by customer class.

TABLE 1.3: IESCO SALES FOR 2009-10

No.	Customer Class	Sales GWH	Proportion %
1.	Domestic	3,309	43.70
2.	Commercial	878	11.60
3.	Industrial	1,672	22.08
4.	Bulk Supply	1,526	20.15
5.	Tube wells	92	1.22
6.	Other	96	1.25
	Total	**7,573**	**100.00**

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

Statistical summary, comparison with other DISCOs

Some significant performance indicators for IESCO are shown in Fig. 1.4. Its transmission and distribution losses reported at 9.8% are the lowest amongst all DISCOs; power distribution losses of the other utilities ranging from 11% to 37%.

The frequency of unplanned outages is almost 97%, whereas the unplanned outages' duration was 32% of total outages' duration. Transformer failure ratio at IESCO was the 2nd highest as compared to the other DISCOs' range of 1.6% - 4.8%.

TABLE 1.4: IESCO 2010 KEY PERFORMANCE INDICATORS

No	Description	Value
1	Transmission & Distribution Losses	9.8%
2	Outages	
	Number of Outages	54,131
	Total Outage Time in Hours	8,828

	Hours per Outage	0.163
3	Transformer Failure (% MVA)	4.04%

IESCO serves about 11% of the electricity distribution market in Pakistan in terms of number of customers, sharing 12% of total energy sold; while contributing 11% to the total revenue collected. It's HT and LT network is about 8% and 12% of the total length of HT and LT lines. The transformer capacity is 10%, nearly in the same proportion as the share in number of customers. The company is responsible for about 11% of the allocated load, and shares 8% of total non-coincident peak demand, of all the DISCOs.

TABLE 1.5: IESCO FY 2010 STATISTICS

Description	All DISCOS*	IESCO	Share (%)
Customers	19,582,224	2,059,207	10.52
Sanctioned Load (MW)	47,855	5,397	11.28
Non-Coincident Peak Demand (MW)	19,288	1,457	7.55
Energy Sales (GWh)	63,660	7,573	11.90
Employees	122,530	13,696	11.18
Revenue (Million Rs)			
- Billed to Customers	488,022	60,433	12.38
- Collected from Customers	517,055	57,954	11.21
Receivables from Customers			
- Private	103,351	2,286	2.21
- Government	58,026	5,276	9.09
Total	161,377	7,562	4.69
Distribution Network			
- HT Line (km)	279,990	22,053	7.88
- LT Line (km)	205,020	24,712	12.05
- Dist Trans Capacity (MVA)	32,524	3,294	10.13

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

IESCO as a whole statistically appears to be a relatively good performer. Its revenue collection was 96% of the billing (other DISCOs range between 60%-97%); with 46 days' billing in arrears (other DISCOs range between 32-416 days). Its human resource was 11% of all DISCOs serving an equivalent size of customer base, but captured a higher share in total energy sales. In year 2009-10, the utility earned a net profit of about Rs. 5.093 billion. Further improvement in its performance would reduce the subsidy burden on the national exchequer.

Within the confines of the Pakistan power sector, IESCO is a relatively high functioning electric distribution utility; it has been able to show a profit as measured by its ability to live within the means of the distribution margin allowed by National Electric Power Regulatory Authority NEPRA. In a larger sense, all eight DISCOs contribute to generating staggering losses from the commercialization of electric

power, but this is due to the fact that the increasing cost of purchased power has not been passed on to the consumer, due to a belief on the part of the Government that consumers are not able to pay the full cost of electric service.

Nonetheless, there are multiple opportunities for IESCO to achieve improved effectiveness and operational efficiency. The purpose of this report is to explore its operating practices and procedures, to identify where it should be able to make improvements in operating practices; and to document the specific policies, procedures & operational practices that will need improvement to contribute to lower operating costs and improved overall financial & technical performance.

1.3 Overview of PDIP Audit Methodology

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

The IESCO 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 IESCO 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

a. Governance

i. Overview

The PDIP team evaluated the structure and activities of the Board of Directors of IESCO to understand how the BOD was configured and with what level of authority it operated. Key findings and analysis of that review are contained in this section of the report. On November 22, 2010 all DISCO Boards were dissolved by order of the MWP, and were recently reconstituted with the appointment of public, private and academic Members, so many of the PDIP observations stated below may not be germane in future months.. However, in the interests of identifying potential improvement opportunities, findings of the review will be presented here nonetheless.

ii. Summary of Key Findings

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

- IESCO's Board has not yet fulfilled its governance responsibilities, lacking the expertise and authority to meet challenges facing the company in the changing Pakistani power sector. BOD powers are limited; a review of Board meeting minutes shows that matters discussed are mostly routine - and it is unclear whether it has the ability to tackle major issues or oversee strategic change.
- The utility is in the process of fulfilling all requirements necessary for becoming a listed company. Accordingly, the Companies Ordinance of 1984 as amended, Section 204(A) requires a listed company to have a full time Company Secretary. As noted, this role is currently being performed by the Finance Director.
- Declaring its intention to reduce the influence of government in DISCO governance and move these utilities towards greater operating independence, MWP recently dissolved the IESCO Board, appointing a new one in its place.
- While the new Board appears to provide a better mix of professionals and stakeholders.

iii. 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. IESCO's BOD consisted of seven members, including the Chief Executive Officer. Because IESCO is wholly owned by the government, MWP appoints all public, and PEPCO all private, Directors according to a formula as follows:

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

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

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

The IESCO BOD has chosen to voluntarily govern itself informally under the Code of Corporate Governance, a set of governing standards for listed companies. These standards are more stringent and as a result the BOD meets on a monthly basis to ensure that "important company business can be reviewed and executed in a timely fashion, as well as to keep uptodate with important issues pertaining to IESCO operation".
In reality, BOD powers are limited and it is uncertain as to how well the BOD could cope with a requirement to consider strategic issues. For example:

- The appointment and performance evaluation of the of the Chief Executive Officer is perhaps the single most important BOD function in most corporations, but the CEO of IESCO has historically been appointed by PEPCO, and is a Member of the Board.
- Similarly, the entire senior executive cadre is appointed (by PEPCO) rather than being recruited through a formal process.
- Members nominated from government agencies were senior in position, and therefore close to retirement, resulting in short tenures and high turnover.
- There was no Member with financial expertise to serve on the Audit Committee.
- Additionally, the CEO serves on the Audit Committee, a clear conflict of interests.

In an effort to understand just what powers the Board actually has, the Book of Financial Powers (BFP) was reviewed and discussed with the BOD's Secretary, who is also the Finance Director. The BFP is a governing document approved by the BOD in October 2002. It establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by IESCO management and BOD in the operation of day-to-day activities. The utility has prepared a draft of proposed changes to the Book to effect more efficient approval authorities, and adjust monetary limits to the current financial climate. These proposals were made to ensure high corporate governance and internal control standards, and are scheduled to be presented to the BOD and to PEPCO for approval. It was observed that the IESCO's BOD had relatively little authority over the utility's management and could not be considered a true corporate board.

MWP's notification of 22 November 2010 dissolving all DISCO, GENCO, and NTDC BODs stated the intention to reconstitute these "on professional lines" as recommended by the Cabinet Committee on Reforms, with special emphasis on representation from consumers. Significant effects of the change include:

- The majority of Directors must come from the private sector.

- Ministers/Secretaries/Government officials may not be nominated as Chairmen.

- Representation from the administrative Ministry/Division be restricted to one.

This decision signals an intention to reduce the influence of Government in the governance of the DISCOs. This notification should be considered a definitive step towards establishing the DISCOs as more independent public corporations. To serve the utilities 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 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; and to advise on proposed new positions. Its role in initial DISCO development was never relinquished. The utilities must be able to manage their own manpower requirements.

b. Engineering Review and Analysis

i. Overview

The PDIP's 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.

IESCO is a utility serving Pakistan's capital and surrounding areas with a total of around 2.1 million consumers; and almost 22,053 km of 11kV HT and 24,712 km of LT distribution lines. Peak demand for FY2009-10 was recorded as 1,457MW and purchases were 8,396 GWh, giving an average annual load factor of about 40 % with 5.16 % annual growth in consumption. The utility serves its customers through 5 operation circles, 19 divisions and 98 subdivisions, with an aggregate Transmission & Distribution loss of 9.8 %.

ii. Summary of Key Findings

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

- **Network—** Initial visits indicated that the transmission system, while heavily loaded and no doubt in need of improvement, was providing adequate service. One issue raised early in the discussions was the matter of transmission losses. During FY2009-10, losses as calculated by subtracting energy received at substation 11kV buses from that delivered at 132kV by NTDC averaged as 2.2%. During the month of December 2010, they were recorded as 1.1%. This would be admirable if it were not so unlikely, a fact recognized by IESCO staff.
- **Losses—**Current estimates of transmission losses are so low that they are not likely accurate. A comprehensive metering initiative at the grid and distribution substations will be required to determine real loss levels in the near future.

Distribution System Management: The PDIP review of distribution system management resulted in 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 IESCO for use. This type of forecast is widely recognized in the industry to have very low utility as it cannot reflect changing conditions. Moreover, five

years is generally considered to be too short a timeframe for such a forecast given long lead-times required for distribution facility planning and construction. The team found no evidence that the data needed to prepare a more acceptable end-use or econometric forecast was 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. 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. This department sends its surveyor to track the feeder, using the odometer on his motorcycle and other estimating means to assess length. The resulting track, along with conductor and transformer size information, is hand drawn on taped together pieces of paper.

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

- **National design standards—**Current national design standards do not adequately address congested area construction, - a problem presented in some urban areas served by IESCO. 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 IESCO, many customers have paid for installation of dedicated transformers ranging in size from 25kVA to 630kVA. In the vast majority of cases these dedicated transformers are installed in the same fashion as the public use transformers, i.e. on overhead platforms.

- **Underground Network—**IESCO is unique among the DISCOS of Pakistan in possessing a substantial underground distribution network, which serves the capital city of Islamabad. This system was constructed at the time the city was built in the 1960's and has received relatively little maintenance since. In particular the LT portion of the network is in very poor condition, with junction boxes missing covers, many casual connections, and other problems creating both opportunity for theft and public hazard.

- **Construction quality**—There are in-house and independent construction inspectors in the Project Division. Construction is carried out by local contractors and the work jointly inspected by M/S Barqab (WAPDA preferred and projected Consultants) and Project Division staff. This approach has the predictable effect of uneven quality of construction. Poles were found to be not properly plumb, transformer platforms not level, and sags of conductors not even.

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

- **Safety**—Eighteen linemen lost their lives while performing company work during the 2009-10 fiscal year. It is highly likely that improved work practices and safety policies could reduce this

number and alter perceptions among the workforce that distribution maintenance and repair work is too dangerous to perform.

- **Meter security**—Meter security was found to be compromised by both the ease that meter installations can be tampered with and the equally vulnerable service drops. Installations in rural areas were especially problematic.
- **Procurement**—IESCO conducts a large number of procurements annually, often for relatively small amounts. Also, procurement practices that are non-standard effectively preclude international companies from bidding, unnecessarily narrowing the competitive field and inhibiting potential savings.

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 IESCO's system should be approximately 13.3% of annual energy (kWh), quite high considering the concentrated nature of much of the company's served load.
- IESCO reported total Transmission & Distribution (T&D) Loss is 9.8% for the 2009-10 fiscal year whereas the reported distribution loss is 7.8%. Given the results of the engineering loss analysis during the Operational Audit, the divergence in reported losses and measured losses points to the need for a comprehensive engineering plan to determine real loss levels throughout the utility's network.

iii. Analysis & Discussion

As noted, of the 2.1 million consumers served 84.5% are domestic while less than 1% are industrial. Nonetheless, only 43% of the commercialized energy is sold to domestic consumers, while 22% is sold to industrial consumers. IESCO employs an underground 11kV distribution network in Islamabad whereas the rest of its network is traditional overhead, radial distribution system. There are a total of 54 grid/substations of 132kV, 10 of 66kV, and 5 of 33kV in IESCO's system. During FY 2009-10 one new grid Station, 5 power transformers, 7 km of 132 kV transmission lines, 505 km of 11kV and 390 km of LT lines were added, in addition to 1,408 new distribution transformers. Five 132kV grid stations are planned to be completed during 2010-11.

The engineering assessment of IESCO consisted of three components. The first is an evaluation of transmission issues. The transmission system at IESCO was not seen as a source of problems and therefore this segment of the evaluation was very limited. The second component is an evaluation of distribution system management resulting from a series of interviews with staff from the Planning and Design, Construction, Operations, and Procurement Departments. During these interviews, company staff responded to the team's questions and provided insight into the technical operations of the utility. These interviews are inevitably influenced by the attitudes of the interviewees 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 selected 11kV feeders that were in the aggregate representative of all IESCO's feeders, and therefore indicative of the level of technical loss of the entire company. An even smaller subset of low voltage (LT) networks was surveyed in detail, with the objective of identifying the contribution of LT systems to the utility's corporate technical losses.

Transmission System Assessment
Initial visits indicated that the transmission system, while heavily loaded, and no doubt in need of improvement, was providing adequate service. One issue raised early in the discussions is the matter of transmission losses. During FY2009-10, losses as calculated by subtracting energy received at substation 11kV buses from that delivered at 132kV by NTDC averaged around 2%. During the month of December 2010, it was recorded as 1.1%. A preliminary estimate of transmission losses using estimated values and a simple model of the system yields a likely transmission loss of 1.4%, including loss in grid substation transformers. It was felt by IESCO's strategic planning unit that a problem exists with metering in the transmission network, potentially either at the NTDC delivery points or at IESCO's sub-stations. Metering systems at both points are manually read at different times, and both company staff and the PDIP team believe this matter can be addressed at relatively low cost, as will be discussed in a later section.

Notwithstanding the determination of transmission losses, there was, as indicated above, no compelling evidence that transmission issues were contributing negatively to IESCO's, financial performance and it was decided early in the assessment to focus effort on distribution issues, which were clearly more demanding.

iv. Distribution System Management Assessment

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

The planning environment at IESCO can best be described as reactive. Planning is carried out mainly in response to problems raised by the operating subdivision, or by the prospect of a new grid/substation the construction of which will require the rerouting and/or bifurcation of feeders. Comments on the various components of utility planning are as follows:

Load Forecasting
A five year load forecast has been historically prepared in collaboration with NTDC; the growth rates are determined by the latter and communicated to IESCO. Most large, well-managed distribution utilities take responsibility for collection of load forecasting data such as population growth, demographics, or historical sales data, but this role has been played by NTDC since IESCO and other DISCOs were established. The process followed, at present, is that IESCO provides data on sales by consumer class to NTDC which prescribes the growth factors; IESCO staff projects demand and energy requirements at the NTDC prescribed rates; and then subdivides the resulting load among the various grid substations. IESCO is aware of the need for change in this practice.

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. When a feeder enters into an overload situation, defined as exceeding a peak load of 300 amps, or the operating subdivision suspects that a distribution transformer is overloaded, it advises the Planning Department. This department sends its surveyor to track the feeder, using the odometer on his motorcycle and other estimating means to assess length. The resulting track, along with conductor and transformer size information is hand drawn on taped together pieces of paper. The information provided by this map is then used as input to the

analysis program. Once the issue that brought the feeder or the transformer to the attention of the Planning Department is resolved the project is archived, and no effort made to maintain or update the feeder information.

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 collected during the course of the project, or to maintain any sort of map database.

System Analysis

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

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

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

Design

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

The only significant alterations in these standards since they were established have been the introduction of concrete poles. Pre-stressed reinforced concrete poles were initially approved, but design is moving toward centrifuged poles due to their higher strength, and the resulting ability to carry three circuits. An additional change has been the adoption, in the 1980's of the Osprey (556MCM 18/1) conductor for 11kV circuits with heavy electrical loading. Osprey has a current carrying capacity of 700 amps (13MVA at 11kV) so should provide considerable capacity. In actuality, the majority of IESCO's 11kV switchgear

is limited to 400 amps per phase by the current transformers in the breakers, hence the need to consider circuit adjustment at 300amps. This limitation severely limits the usefulness of the Osprey conductor.

One area which IESCO has not pursued and which could have an impact on its operations is the use of multiplex or aerial bundled cable (ABC) LT line. While there are no congested areas in which covered LT would be required, it could be used to reduce the possibility of unauthorized hooking, or "*kunda connections*".

IESCO is unique among Pakistan's DISCOs in that it administers a significant underground distribution system serving the city of Islamabad. This system uses 11kV primary cables in duct banks to serve relatively large transformers of 200kVA or more. An LT network radiates from these transformers and LT cables are periodically brought above ground into junction boxes where service connections are made to consumers. The design of the system was based on standard practice at the time it was built, and if it were well-maintained, could continue to supply adequate service.

While the 11kV portion of the network is in an acceptable condition, the LT network has deteriorated significantly. The boxes have been vandalized and very few have covers. Since the number of services often exceeds the capacity of the box, various informal methods are used to extract additional services Meter installations are chaotic and poorly secured, and the whole system suffers frequent failures and is a conspicuous public hazard.

Construction

The mission of the Project Department at IESCO, as stated by the Project Director Construction, is that of execution. He emphasized that the department does neither design nor procurement but is responsible for construction of all distribution facilities in the IESCO's service area. However, proposals are prepared for village electrification after performing physical surveys of the areas sponsored under Member of National Assembly (MNA) & Member of Provincial Assembly (MPA) funds. The projects undertaken by the Project Department fall into four categories:

- Those funded from IESCO's budget for distribution upgrading and loss reduction.
- Those under the Power Distribution Enhancement Investment Program funded by the Asian Development Bank (mainly meter upgrades).
- Deposit work paid for by others, such as line relocation required by road widening, customers seeking independent feeders, or housing societies.
- Village electrification funded by the federal/provincial governments.

There is no village electrification master plan, so the annual budget does not contain any expenditure for this purpose. Rather, MNAs/MPAs identify areas they want electrified, and obtain the required allocations from the national/local government based on their rapport with the ruling party/current government. According to the rules governing such projects, IESCO can include in the budget only those amounts required for the necessary line extension. There is no planning study to determine what effects this will have on the backbone system, or whether voltage service will be adequate once the service is constructed. These problems are all left for the DISCO to correct or accommodate during the operational phase.

For village electrification, the Project Department examines the locale of the project and prepares its own proposal and material list for drawing on stores. At this stage M/S Barqab Consultants review the proposal and later verify the material used in the project. 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 constructs all projects with its own workforce, with the exception of setting of concrete poles which is contracted out. The Project Division is self-inspecting, i.e. there are no construction inspectors as such. Each responsible foreman and line superintendent is supposed to inspect 100% of the construction, with higher level officers required to inspect declining amounts of the work. M/S Barqab merely verifies the material consumption for individual village electrification projects.

A field inspection of the IESCO's system by the PDIP engineering team indicated that the work was generally well done but lacking in specific items. In particular, even though most of the older installations used connectors, none, or very few of the newer projects did. On new projects, connections were wrapped or served, and full tension conductor splices did not use joining sleeves but were served as well. The use of served connections will certainly contribute to overheating in the future.

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

Operations and Maintenance

The fundamental organizational unit for operations at IESCO is the subdivision, of which as specified above there are 149 in the company, each serving approximately 14,000 consumers. Operations subdivisions are defined geographically by feeder service areas, and are grouped into divisions with an average of four subdivisions per division for a total of 35 operations divisions. Divisions are grouped into circles with approximately four to six divisions per circle. The company has a total of nine operations circles. In addition to the operations subdivisions, there are other subdivisions for Meters and Testing, as well as for construction.

PDIP's engineering team visited Islamabad and Rawalpindi Circles to understand how the divisions and subdivisions are managed. As of November, 2010, Islamabad circle serves 298,718 customers through four divisions and 15 subdivisions. There are a total of 7,609 distribution transformers of various capacities totaling 1,000 MVA with 3,920 km of HT and 3,709 km of LT lines. Rawalpindi circle serves 698,450 customers through six divisions and 35 subdivisions. The circle has 11,445 distribution transformers of various capacities, totaling 1,153 MVA with 4,075 km of HT and 5,901 km of LT lines.

The principle activities of subdivision staff are as follows:

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

Each subdivision 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, infirmities and overweight, although this could not be verified.

Each subdivision has a complaint center to receive and log complaints, and at least one lineman per shift to respond to them. The complaints are made either in person or by telephone, and recorded in rough form on notepaper, transferring the information later to a ledger.

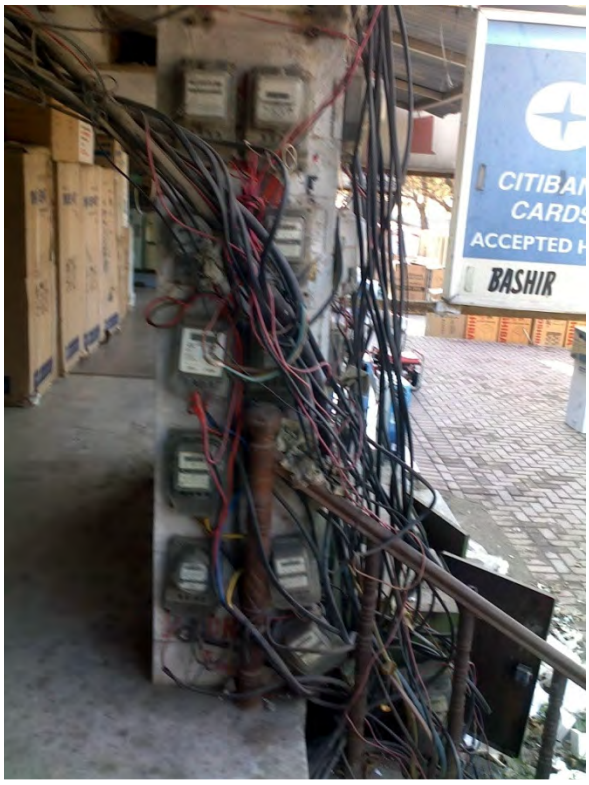
In the subdivision complaint center visited by the PDIP team the lineman on call was waiting in the complaint center to be dispatched. His tools were inspected and found to consist of a hard hat, leather and rubber gloves, a climbing belt, and a collection of hand tools such as pliers and screwdrivers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

In addition to the hand tools, the complaint center had some larger tools including a grounding set, fiberglass ladders, and various switch sticks & tree trimming hooks. The grounding sets were of a design that simply hang 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 pieced together fiberglass handles. Neither type of handle had a surface finish that would be considered adequate for use on high voltage lines. All the switch sticks and ladders were stored in ways and places that exposed them to damage from other items lying against them. The tree trimming hooks were dull and unlikely to be of any use whatever. The subdivision building was very cramped and in poor condition, and the stores area mainly full of debris such as broken insulators, recovered wire and hardware etc. No doubt some of these items were to be reused to restore service, but there was little new material to be seen.

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

The installation and state of energy meters being used in the field were deplorable. Similarly, the use by the utility of service drop conductors that are neither concentric (protected by a concentric neutral shield against tampering) nor enclosed in a metal mast makes the entire drop vulnerable to tampering with the cable. Figure 2.1 below shows a number of meters installed with open terminal covers, in a fashion where all sorts of hazards could occur. The installations were neither safe nor secure for the general public in spite of being in service. The team could not comprehend how these meters were being read and maintained.

Figure 2.1 IESCO meter installations.



Figures 2.2 a and 2.2 b below illustrate the LT distribution boxes installed in Islamabad City without proper covers; concrete slabs are often used to cover them - a potential source of pilferage and a very real safety hazard for the general public, especially for children playing in the streets or near their homes. As per the information given by the Superintending Engineer heading Islamabad Circle, there are about 18,000 such LT distribution boxes needing immediate replacement.

Figures 2.2 a and b. LT distribution boxes.

One of the maintenance objectives of the subdivision is to maintain a log of measurements of loading of transformers, and to periodically rebalance the loads 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.

Clear examples of inadequate installation and maintenance practices prevalent in IESCO territory are illustrated by the following pictures. Figure 2.3a shows an open LT compartment of a pad-mounted transformer, while Figure 2.3b shows a transformer buried in rubble and subject to being easily damaged.

Figures 2.3 a. LT transformer compartment

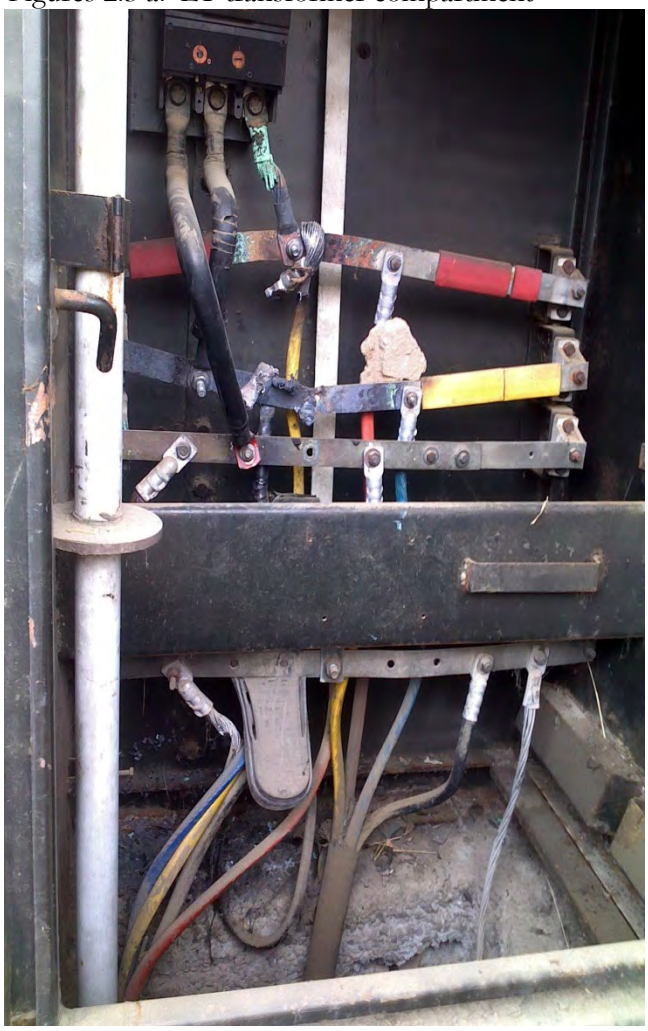


Figure 2.3.b. Pad mounted transformer.

Similarly, unplanned piecemeal growth of the LT network can give rise to sub-standard service installations. During field inspections by the PDIP team, members noted sub-standard, over-loaded LT distribution circuits with un-insulated LT conductor and worn and deteriorated PVC services in narrow streets. When this occurs, it can result in high line losses and frequent outages, as well as serious personal injury to residents and line workers. Figure 2.4 illustrates congested area LT circuits.

Figure 2.4 Congested LT circuits in Islamabad.

The subdivision had one or two light vehicles for general transportation, of which one vehicle is reserved for the use of the Sub Divisional Officer (SDO) and the second is 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 trouble call linemen are only able to carry hand tools for trouble calls. If more extensive work requires heavier tools and more line personnel, repairs are scheduled through the subdivision operations office.

The subdivision offices do not practice line patrol duties such as line inspection, load measurement, and load balancing activities. As a result, IESCO sustained over 1,400 damaged transformers in 2010.

The IESCO's inspection visit also noted that most of the 11 kV capacitor banks were disconnected. The reason given by the sub-divisional officer was that these are all faulty capacitor banks. He also indicated that the line staff often disconnect these capacitors in the pretext of causing increased line outages.

The issue of lineman safety was discussed with division and subdivision staff. IESCO suffered a total of 12 fatal lineman accidents and six public fatalities during the 2009-10 fiscal year. It has about 2,361 climbing linemen (classes LM-I and LM-II), not including assistant linemen (ALM) who are not allowed to climb poles, and line supervisors. A fatality rate of a dozen per annum is extremely troubling and signals a serious problem with safety.

Lineman fatalities comprised approx. 30% from electrocutions and 70% from falls; most accidents blamed by management on failure of the linemen to use available protective equipment. In some cases electrocutions were reportedly caused by backfeeds to the low voltage network, combined with failure to install earthing sets.

Given the high level of lineman fatalities, IESCO is experiencing difficulty in convincing assistant linemen to transition to full climbing linemen; and certainly most linemen observed by the engineering team to be climbing poles were senior.

The team observes that issues affecting lineman safety in electric utilities are not unique to IESCO 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 IESCO fall into this category. The belts are too narrow and uncomfortable to lean into for any length of time, and the grounding sets of a design 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 the lack of transport.
- While construction standards neither consider maintenance requirements nor provide adequate clearances for linemen to work or climb near energized conductors as frequently observed in other DISCOs, it is generally not an issue in IESCO as WAPDA standards are adequately complied with.
- Inadequate tools for cutting, lifting, and pulling requiring linemen to exert force, either pulling or pushing, that can result in injury if the load shifts unexpectedly.
- Poor tagging and clearance practices. It was reported that some line work is done during load shedding outages, without proper work permits preventing lines from being reenergized.
- Inadequate training in safety practices at lineman training schools. This needs further evaluation.
- Pressure from supervisors to sidestep safety procedures in order to complete work. This was reported by IESCO staff but needs further examination.
- Poor work planning procedures that do not consider safety a primary goal of the project.
- Failure to maintain an environment in which safety is emphasized on a daily basis as part of the work schedule.
- Lack of sanctions for staff that knowingly violate safety procedures and by their example encourage others to do so.

Meter Security

IESCO has not undertaken a large scale campaign to replace electromechanical meters with electronic units; however, approximately 90% of meters remain electromechanical. This means that meter vulnerabilities at the DISCO have remained static, that attempts by consumers to disable meters by tilting, dirtying, or otherwise stopping the meter disc continue, and that gradual loss of meter accuracy occurs 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. In order to address this issue of ingress and illegal access to terminals, IESCO has launched a campaign to secure meter terminals and boxes by pasting bar coded "security slips" thereon as shown in Figure 2.5 below.

Figure 2.5. Meter security slips.

IESCO's generally low level of losses indicates that these vulnerabilities are not a major issue, and observation indicated that most meters specially in urban areas of Islamabad city were properly attached to the building or bracket and were upright and relatively clean. Bottom connections on the meters were somewhat covered or sealed by the security slips however, and IESCO does not have a meter testing program, so older meters are likely to be slow. The inspection of the meter fleet indicates that in most urban areas of Islamabad city, meters are generally secure with primitive methods. However, in several residential as well as rural areas of IESCO, the PDIP team observed meter connections not covered or sealed.

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

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

Most suppliers for items produced in Pakistan are sourced from the local market. Although there is no prohibition against foreign suppliers, all 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 the vendors in Pakistan. Procurements for projects funded with donor funds (World Bank, ADB etc.) follow different procedures and are handled by the respective project management units.

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

v. Distribution Feeder Mapping and Loss Segregation Analysis

As discussed in the Methodology section, an evaluation of technical and non–technical losses for the IESCO's distribution system has been performed by modeling a small sample of IESCO feeders. The process employed began with selection of feeders on the basis of a consistent sampling method, mapping the feeders using a simplified GIS tool, collection of feeder peak load and power factor data from substation feeder metering, and modeling of the feeders using power flow software.

The intent of the exercise is to estimate technical losses using a random sample-selection method, resulting in a valid proxy for the technical losses of the entire system. The difference between the total distribution losses and the technical losses so determined can then be presumed to represent non-technical (administrative and commercial) losses. Further, the power flow model will allow segregation of technical loss between 11kV lines, distribution transformers, LT networks and service drops.

Selection of Feeders
According to data provided during its annual business plan presentation in October 2010, IESCO has approximately 22,000 km of 11kV feeders. Clearly, in order to select a sample of feeders representative of the utility feeder population as a whole, it will be necessary to employ a sampling technique with specific criteria. The sampling criteria chosen were as follows:

- Average feeder length of sample population should be close to the average feeder length of the overall feeder population.

Distribution of sales in kWh/year between domestic, commercial, industrial, agricultural and other consumers for the population of sample feeders should be close to that of the overall feeder population.

- The proportion of rural and urban consumers in the sample feeders should be similar to that in the system as a whole.
- The sample feeders should have complete data, including total sales and feeder input data, and total length. Feeders with data anomalies would be excluded.

Data was obtained from IESCO on the entire feeder database. Because the CIS links customers to the feeder that serves them, it is possible to obtain data on sales by feeder and this was also requested. Feeders are classified as urban (U) or rural (R). Issues with the data provided are summarized below:

- The utility provided data on a total of 760 feeders; however 24 of these had sales of zero for FY2010. This means there are a total 736 active feeders.
- A total of 310 feeders lacked data on length. However the total length of the feeders calculated from this data is almost 32,000km, which is 10,000km greater than the total length of 11 kV line provided in the presentation made by IESCO in October 2010 in the start-up workshop in Islamabad. The average length of the feeders for which length data was supplied is 73km. This is almost certainly longer than the average for the entire system.
- Individual feeder loss data was neither available nor possible to calculate with the information provided.

The anomalies in the data are difficult to explain. There are simply too many feeders with missing or incomplete data for this to be caused by bureaucratic delay in updating records.

After excluding feeders with anomalous or missing data, a selection was made using a random number system and tested against the criteria. Initially four feeders emanating from four different grid substations were chosen for mapping. A fifth underground feeder was later selected at IESCO's request for Islamabad city. 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 Selection of IESCO feeders and their characteristics.

Feeder Name	Length	Demand	Sales MWH				
	km	Amps	Domestic	Commercial	Industrial	Agricultural	Other
HAZRO	58.0	288	10,040	2,038	970	480	63
NEW RAWAT	27.5	144	4,376	2,068	1,368	3	72
BHONE	142.6	216	8,440	554	2,735	539	70
MUSEUM	30.1	310	6,245	914	7,766	71	19
SITARA MARKET	8.5	160	11,856	1,799	230	39	0
Sample Average	53.3		65.0%	11.7%	20.7%	1.8%	0.4%
IESCO Average	**73.0**		**47.5%**	**12.6%**	**24.0%**	**1.3%**	**14,56%**

Table 2.1 also shows the sales breakdown for the sample of feeders chosen for mapping. The length of the feeders chosen for mapping averages 53.3km, compared with an average length of 73km for the system as a whole. The average was reduced when a small city feeder was added to the sample as noted above. Also, the lengths calculated by GIS survey turned out to be shorter than those provided by IESCO. The sales breakdown between consumer types for the sample urban feeders is close to that of the system especially for commercial, industrial and agricultural consumptions as a whole.

Mapping and Modeling of Feeders and LT Networks

The feeders were all mapped using a rapid GIS technique that identifies only corner and intersection poles, and poles with equipment installed on them. Observable data such as conductor size, transformer capacity, and transformer status whether general service or dedicated, was noted manually and transferred to an attribute database. Once the circuit was mapped, the information was transferred to a Milsoft Windmil model. This is a standard distribution analysis software used widely in the US and Latin America. It can model single or three phase loads, and 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 IESCO are Osprey, Dog, and Rabbit, with some Panther and Gopher, all of which are ACSR conductors. LT conductors are mainly Wasp and Ant, which are all aluminum conductors. Characteristics for these conductors were obtained from tables and incorporated into the database. Similarly, IESCO specifies transformers with maximum allowable levels of losses, a legacy of WAPDA procurement practices. These levels have recently been changed, but none of the new units have been supplied yet. Transformer characteristics used in the model therefore correspond to archaic IESCO transformer values of no-load and load losses, as shown in Table 2.2 below:

Table 2.2. Transformer characteristics.

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

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

While Milsoft can accept data on location linked consumer loading, the time available for this project did not permit data on actual loading to be used in the model. Instead, the feeder peak load was obtained from substation records, and this known load 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 value for 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, an assumed bus voltage of 11.5kV, and the differences between the hourly kWh meter readings to estimate kW. The result of this calculation is presented in Table 2.3 below for the sample feeders.

Table 2.3 Feeder power factors.

Feeder Name	Power Factor At Max Load %	Power Factor at Min Load %
HAZRO	73%	71%
NEW RAWAT	94%	100%
BHONE	82%	64%
MUSEUM	100%	100%
SITARA MARKET	100%	100%

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

Once the model, loading, and power factor are established the feeder power flow analysis can be carried out. Table 2.4 shows the results, disaggregated by line (conductor) loss, and transformer no load and load loss.

Table 2.4. Modeled losses for selected IESCO feeders.

Feeder Name	Length km	Peak Demand kW	Line Loss kW	Transformer Loss	
				No-Load kW	Load Loss kW
HAZRO	57.95	4,005	927.9	42.9	44.1
NEW RAWAT	27.45	2,579	254.6	34.1	12.2
BHONE	142.55	3,374	472.2	44.6	29.3
MUSEUM	30.1	5,906	320.9	29.1	75.3
SITARA MARKET	8.5	3,048	59.0	16.7	20.4

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. Due to limited time, a total of three 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 consumers located on the LT networks are billed by kWh consumption only, it was necessary to covert the kWh data to demand (kW) for modeling. As no measurements of actual demand were available, it was necessary to estimate demand using only the average energy consumption of the consumers. In order to determine the peak demand in kW likely from consumers on each LT network during the month of June, the data on consumption was applied to the demand equation below. This equation was derived many years ago by the Rural Electrification Administration (REA) in the United

States, and has been verified by NRECA as acceptably accurate for use in developing countries as well. The equation is as follows:

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

Where:

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

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

Table 2.5. LT circuit losses.

Feeder Name	U/R	LT Length	Transformer Size	LT Source Load	Source p.f. (%)	Total Losses		
		(km)	kVA	kW		kW	% Loss	W/kVA
Chakwal_Bhaun	R	3.23	200	115	83	8.04	7%	40.2
Chakwal_Bhaun	R	1.76	200	148	83	4.89	3%	24.45
Rawat_New_Rawat	R	1.21	100	107	80	19.1	18%	191
					Average LT		9%	64.06

The results of the LT analysis show that LT losses vary from 3% to 18% of the power delivered by the transformer. Average loss for the LT network is 9%. The lengths of both urban and rural LT networks were in the order of 2000 meters per transformer. Loading for this group of transformers varied from loads of no more than 70% of capacity to 133% of capacity. Of the transformers chosen, only the one overloaded transformer exceeded 33% of its capacity in June 2010. No attempt was made to assess balance since it was clear that only a relatively few of IESCO's transformer are likely to be overloaded.

For purposes of this analysis, it is necessary to generalize these results so 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 64.06 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 premises. 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

this process has not been completed in many urban areas, with the meters still located on the exterior of the buildings. For this reason, the average service drop length has been assumed to be 12 meters. Table 2.6 below indicates the assumptions for the three types of consumer.

Table 2.6 Service drop assumptions.

TABLE 2.6 CHARACTERISTICS OF SERVICE CONDUCTOR

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

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

Loss Summary and Segregation Analysis

Once the components of demand loss have been calculated, it is necessary to convert the values derived from demand loss on peak to average energy loss. Because losses are a function of the square of load, it is necessary to account for the variation in load during the course of a year. The classical method 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 IESCO 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 IESCO, and the loss load factor calculated according to the given equation. The same feeder loss load factor was applied to all components of loss. The results for the sampled feeders are shown in Table 2.7 below:

Table 2.7. Combined losses for IESCO distribution circuits.

TABLE 2.7 RESULTS OFPRELIMINARY LOSS ANALYSIS BASED ON A SAMPLE OF FEEDERS					
Feeder Type	**Conductor Loss %**	**Transformer Loss %**	**LT Network Loss %**	**Service Drop Loss %**	**Annual Energy Loss %**
Total Sample	5.22%	2.75%	5.62%	0.13%	13.72%

Because the sample was chosen to be representative of IESCO as a whole, the interpretation of this result is that the technical losses of the utility's distribution system are in the range of 13.7%. The technical analyses of these sample feeders were already carried out by IESCO and the average loss of these sample feeders is about 15.6% which is very close to what PDIP engineering team has determined. However, there seem to be some anomalies with the data provided by IESCO which is not consistent and as such these results cannot be applied to its entire system. The company prepared a comparison of technical loss and segregated administrative (non-technical) loss for about 208 feeders. The results are very close to PDIP findings. It should be noted as detailed below that reported losses are 9.8%; inconsistent with the findings of both of IESCO and PDIP loss analysis. This indicates the need for a comprehensive planning and loss evaluation study for IESCO.

Validation

In the IESCO report to MWP October 2010, system losses were reported to be 9.8% including distribution losses, transmission and transformation losses, and administrative losses. Though there is a variance with the results presented here, nonetheless it was decided to carry out an independent evaluation using a benchmarking technique developed for electric systems in the rural US. Studies conducted by the Rural Utilities Service, the financing and monitoring arm of the US rural electric program have determined that for systems using conductors and voltages typical of good engineering practice, distribution system loss is a complex function mainly of sales density, which is MWH 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 IESCO results in Table 2.8:

Table 2.8. Benchmarked losses for IESCO.

IESCO BENCHMARKED LOSSES			
HT & LT Km	Sales Density MWh/Km	Benchmark Technical Loss %	Actual Distribution Loss %
49,983	151.5	6.9%	7.8%

It is apparent that according to this benchmark, IESCO should have a distribution loss of approximately 6.9%. If the reported losses of 7.8% are correct, then approximately 0.9% of those losses are non-technical.

Possible Technical Opportunities for Reduction of Non-technical Loss

The fact that the majority of IESCO's losses are technical does not preclude an effort to further reduce non-technical loss. 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 providing 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.
- Substandard lengthy LT lines and worn, deteriorated services with several joints, existing in narrow streets and congested areas may be replaced with Aerial Bundle Conductor (ABC).
- LT distribution boxes in the underground system in Islamabad city area must be properly maintained by replacing damaged distribution boxes and missing accessories such as covers; and rectifying other defects and anomalies e.g. substandard cables, damaged LT bus bars, faulty compression lugs and inappropriate concrete plinths etc. After necessary repair of distribution boxes and providing internal locks to covers, each box should be painted in a specific color with a mark "Danger" thereon both by diagram and in writing (Urdu/English) to be clear to consumers whatever their age or educational level.
- The engineering team was advised that approximately 90% of IESCO 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 with electronic units may be more expensive an activity than IESCO wishes to undertake at present, a campaign for testing of the existing meters would have immediate results at much reduced cost.
- Meter reading improvements that minimize the number of errors prone manual transcriptions of data would help reduce errors and assist in identifying problematic meters for replacement.

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

c. Financial

i. Overview

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

ii. Summary of Key Findings

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

Cash Receipts and Disbursements:

- IESCO's collection rate for government clients – 83.2%, is much lower than for private clients – 98.4%. GOP accounting regulations prohibit making provision for past due receivables from government clients, therefore the utility must consider all government receivables collectible.
- A particular problem for IESCO with respect to government receivables is the power sale to AJK, amounting to 10% of its total sales. The tariff for this sale is less than the cost of wholesale power, so even if payment were current it would still constitute a loss. However, the Government of AJK is disputing the billings and a significant receivable has built up. It would be best if the sale to this region were made directly by CPPA, using the IESCO system for delivery. This would remove both the purchase liability and the receivable from the company's books and significantly improve its financial position.
- IESCO is forced to remit payments for GST on all billings, regardless of whether the bills are actually collected. Thus even though taxes are considered a pass-through, the difference between billed and collected taxes are paid from the utility's distribution margin. These taxes represent a significant financial burden.

Financing and Investments:

- In 2008 four DISCOs were asked by GOP to obtain loans to pay for government shortfalls in power costs incurred by all DISCOs. IESCO was required to absorb a portion of the interest expense incurred on these loans.
- Though it has revenues of Rs. 66 billion ($US 792 million) per year IESCO could afford to undertake only about $63 million of system investment in 2009-10. This level of investment may be insufficient to maintain its distribution infrastructure over the long term.

Internal Controls:

- IESCO's annual financial audit makes no reference to shortages in distribution and transmission stores. This is significant since there were specific references to store shortages in the annual audited financial statements of five other Pakistani DISCOs.
- The Internal Audit Department functions mainly 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 this department due to its lack of autonomy and

professional competence. The existing Audit Manual does not address the specific audit procedures required to perform internal auditing procedures as the organization has evolved and new system processes introduced.

Cost Containment:

- IESCO's fleet comprises a total of 600 vehicles, 200 of which are 20 years old or older. The company's fleet management policy ostensibly requires vehicle replacement every ten years, but vehicles are rarely replaced on schedule due to conflicting approval policies, even given the rationale of lower operating and maintenance costs for new vehicles. Not surprisingly, older vehicle maintenance costs are significant.

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

Financial Reporting:

- The current accounting system is unable to meet IESCO's growing needs. The DISCO is an entity comprising geographically disbursed cost/revenue centers. There is extreme complexity in the number and type of transactions and data flowing between its various regions and headquarters. In addition, there are numerous offices requiring an integrated information system solution. An ERP solution was approved by the BOD and NEPRA, and has been included in IESCO's most recent tariff to the amount of Rs. 150 million. However, this project is unable to procure the necessary resources to progress due to pending PEPCO approval.

Financial Performance:

- Maintenance expense as a percentage of operating revenue indicates that IESCO is spending significantly less – 1.02%, than are the US rural electric cooperatives – 7.98%, to maintain its electric system. However this is partly explained by the fact that IESCO 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 IESCO has significantly more operating revenue remaining after power costs to support its existing plant through operations and maintenance expense - 3.8, when compared to the US cooperatives - 6.3. A smaller plant revenue ratio indicates higher revenue per unit of investments in plant. The US cooperatives have invested significantly more in total plant per kilometer of line - Rs. 2,622,327, than has IESCO - Rs. 729,886.

- The amount of trade debt receivables over 60 days as a percentage of operating revenue is significantly higher for IESCO - 2.0%, than for the US cooperatives - 0.23%. This comparison is based upon FY 2010 IESCO trade debt.

- The US cooperatives' consumer density averages 8 consumers per kilometer, while IESCO has 45 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while IESCO's consumer to employee ratio is 154 to 1. Even though IESCO is above average in consumers per employee when compared to other DISCOs (see Table 10 below), it could improve its financial position significantly by improving its consumer to employee ratio. Were it able to achieve a consumer to employee ratio close to 467:1, the savings would approach Rs. 1.9 billion per year.

iii. Analysis & Discussion

Financial management responsibilities rest with the entire IESCO management structure. However, direct supervision of financial management lies with the Director Finance, responsible for cash receipts & disbursements, financing & investment, internal control, cost containment, and financial reporting. This report highlights the important aspects of each of these functional areas.

Cash Receipts and Disbursements

IESCO receives cash from various pay points including banks, post offices and NADRA with methods of payment including cash, online banking and credit cards. All payment collection centers are required to transfer funds collected (net of collection fees) to the respective IESCO central bank account. The utility receives 85% of its deposits the same day in its bank account. The remaining 15%, received from post offices, take upto a week to be transferred to the primary bank account. IESCO then makes periodic payments from central bank accounts to PEPCO/CPPA, after deducting the distribution margin and applicable taxes. Taxes are paid directly to local, provincial and central government authorities, while the DISCOs are authorized to employ their distribution margins to finance non-power operating costs. While improvements can be made to improve cash transfers, a significant portion of payment receipts are transferred to the IESCO account on a timely basis.

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

IESCO annual reports show significant trade debt receivables. IESCO makes provision for 100% of trade debt accounts aged 3 years or more.

In fiscal years 2009 and 2010, the trade debts written off were Rs. 725,355 and Rs. 351,612 respectively. Provincial and federal trade debts are required to have no provision related to electricity sales, but may make provision for non electricity sales related receivables. Provision expense is included as an operations expense for purposes of Distribution Margin (DM, and the size of the provision expense may have a limited impact on the amount of DM received. In an analysis of FY 2010 trade debt receivables over 60 days as a percentage of operating revenue, IESCO was somewhat higher at 2.0% as compared to US electric cooperatives at 0.23%.

Based on the provision of trade debt receivables, IESCO accumulates provisions for past due accounts receivables under the observation that these accounts are uncollectable. Its cumulative total provisions amount to Rs. 819,350,134. Given that the company considers these accounts uncollectable, it makes no further attempt to collect them. Alternatively, IESCO could consider engaging a collection agency to make further attempts regarding these accounts, paying a percentage of the collected total towards achieving the targets, on a contingency basis.

Additionally, IESCO receivables from government accounts equal Rs. 7,434,870,215. A sum of Rs. 4,628.236 million (June 30, 2010) has been accumulated since February 24, 2007 due to less payments on account of tariff differential i.e. tariff notified by the GOP and being paid by the AJK Govt. The AJK Government receivables have increased to Rs. 5,233.46 million as at November 2010. The tariff rates for the AJK Government are required to be determined by the Standing Sub Committee constituted for tariff determination, and there is a gap between the NEPRA determined tariff and that determined by the Committee.

The IESCO collection rate for government clients is much lower than it is for private clients; the collection rate for government clients is 83.2%, while IEPCO has a collection rate for private clients of 98.4%. The IESCO collection rate for commercialized and government clients is 100%. IESCO does not make provisions for uncollected government accounts; GOP accounting regulations prohibit making provision for past due receivables from government clients and the DISCO is required to consider all government receivables as collectible. A legal remedy will be required to force the government to pay past due debts – or perhaps to allow a tax offset against aging, unpaid electric bills.

IESCO 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, IESCO is forced to remit payments for this tax on all billings, regardless of whether the bills are actually collected. Thus, even though taxes are considered a pass-through, the difference between billed and collected taxes is paid from the DISCO's distribution margin. These taxes are netted against GST due and may represent a significant burden for those utilities with low collection rates. However, IESCO had a net general sales tax receivable of Rs. 464,584,849 at FY 2010.

Financing and Investments

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

Local banks are not enthusiastic about extending long-term credit to the DISCOS, since as government entities they are subject to political requirements not always aligned with the DISCO's individual financial sustainability. A case in point is the earlier quoted example of the 2008 DISCO loans to subsidies govt. power payments, which affected IESCO as well.

Generally, cash flow generated by operations is satisfactory only for meeting short term needs, making IESCO 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. IESCO, though it has revenues of Rs 66 billion ($US 792 million) per year, could only reliably undertake about $63 million of system investment in 2009-10. This level of investment may be insufficient to maintain the distribution infrastructure over the long term.

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 with calculated benefits proceed. The documentation required 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. IESCO's rate of return on rate base may range from 13%-17%.

Internal Control

The team visited a regional warehouse site location and reviewed policies, procedures and operations. IESCO's 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 4 regional warehouses and 5 field warehouses. The IESCO Annual Financial Audit included no observations with regard to shortages in distribution and transmission stores. As mentioned, this is significant given store shortages noted in the annual audits of 5 other DISCOs. During our discussions and observations the following strengths were noted in warehouse operations:

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

It was noted that the value of slow moving and obsolete items accounted for approximately 4% of the main warehouse total. While the BOD has the authority to approve/write off amounts, action is generally slow and not taken without PEPCO approval.

The regional warehouse facilities observed were built in the 1960s in rural surroundings. However, the rapid and widespread urbanization has rendered the existing facilities inadequate to meet the needs of an operationally efficient & secure store.

The Book of Financial Powers (BFP) is a governing document approved by the BOD in October 2002. It establishes various approval authorities and monetary limits for financial transactions, and certain other actions taken by IESCO Management and Board in the operation of routine activities. The Book was reviewed and discussed with the Board's Secretary, who is also Finance Director. IESCO has prepared a draft of proposed changes to the BFP to address more efficient approval authorities and adjust monetary limits to reflect the current financial environment. These proposed changes were made with regards to maintaining high corporate governance and internal control standards. This proposal is scheduled to be presented to the BOD and may be subject to approval by PEPCO.

In a review of the Internal Audit (IA) function, it was determined that IA operations employ approximately 70 people. The department continues to employ the WAPDA Audit Manual dated August 1985. In addition to this it uses a Revenue Audit Manual issued by WAPDA in June 1998 to replace Chapters 1 & 6 of the Audit Manual. The Revenue Manual was designed to assist in the review and certification of consumer electricity billings, and to report to management the status of compliance of policies & procedures concerning commercial operations. The functions of the IA Division, as defined in the Audit Manual under section 2.1, are "to ensure that rules & 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 & irregularities noticed in such accounts/ books rectified as far as possible". The IA Dept. performs only a limited review comprising three types of audit: a revenue audit, primarily related to electricity billing; a financial audit, primarily transaction based to verify amounts received and billed; and a fixed asset audit, which traces physical assets to recorded assets and vice versa. The unit generally accounts for 40 to 50 investigations per annum.

The Finance Director was concerned about the inability to fill three key positions: Manager Corporate Accounts, Manager Corporate Planning, and Manager Project Financing. Under the current environment, these positions would require PEPCO's involvement and approval.

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 requirements that are not cost competitive with private sector sources. The application of these requirements however is not uniform across all DISCOs, so opportunities for savings may vary from one to the other.

In the case of IESCO, vehicle fleet maintenance costs were discussed with the Director HR. The IESCO vehicle fleet consists of a total of approximately 600 vehicles; approximately 200 of these vehicles are 20 years of age or older. The IESCO fleet management policy requires vehicle replacement every ten years, while the private sector practice usually requires replacement after five years.;
Even though IESCO has a ten year replacement policy, this policy is not strictly followed. Even if IESCO were to demonstrate that purchase of a new vehicle would result in lower operating and maintenance costs, there is no policy which would allow for a replacement of a vehicle.

IESCO is currently paying PEPCO approximately Rs. 9,000,000 as a software license fee for three applications (billing, payroll and inventories). This expense is likely to be eliminated with expected dissolution of PEPCO, helping to fund the migration to ERP.

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

Financial Reporting

IESCO's accounting system is primarily manual and PC based with less than optimum reporting capabilities. A recent management report noted the need to improve financial reporting and system controls by updating the current accounting manual and implementing a computerized system. As noted, a BOD/NEPRA endorsed ERP proposal for Rs.150m is pending PEPCO approval. An ERP based system is recommended and would include the following applications:

Financials

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

Materials Management

1. Purchasing
2. Inventory management
3. Order management

Human Resource Management

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

The benefits of a system include:

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

As part of the conversion from a manual to a computerized system, the Finance Department has established a system implementation team tasked to produce a manual describing the processes & system controls for the design/administration of policies & procedures necessary to safeguard the company's assets. The manual is nearly complete and will represent a valuable resource for system design, training and internal audit review. The PDIP team considers this a best practice which should be part of any future change management implementation process in other DISCOs.

A successful and sustainable implementation of an ERP system should include an adequately staffed IT department, employee involvement, processes & system controls assessment, and training at all levels as necessary.

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 reasonably 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.

Maintenance expense as a percentage of operating revenue indicates that IESCO is spending significantly less than US rural electric cooperatives to maintain its electric system, 1.02% for IESCO compared to 7.98% for rural electric cooperatives. However, this is somewhat explained by the fact that IESCO 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 IESCO has significantly more operating revenue remaining after power costs to support its existing plant through operations and maintenance expense when compared to rural electric cooperatives, 3.8 for IESCO and 6.3 for rural electric cooperatives. The rural electric cooperatives have invested significantly more in total plant per kilometer of line than IESCO, Rs 2,622,327 for rural electric cooperatives and Rs 729,886 for IESCO.

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.

IESCO's long term debt as a % of total capitalization is exemplary at only 11.3% as compared to US cooperatives at 52.0%. Also, equity as a % of total assets of 33.1% is considered favorable when compared to US cooperatives at 42.4%.

The amount of trade debt receivables over 60 days as a percentage of operating revenue is significantly higher for IESCO than for US electric cooperatives: IESCOs trade debt to operating revenue ratio is 2.0%, while the US electric cooperative average is 0.23%. This comparison is based upon FY 2010 IESCO trade debt.

US electric cooperative consumer density averages 8 consumers per kilometer, while IESCO has 45 consumers per kilometer of line. The large US cooperatives have consumers to employee ratios of 467/1, while IESCO's consumer to employee ratio is 154 to 1. Even though IESCO is above average in consumers per employee when compared to other DISCOs (see Table 3.1 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 IESCO able to achieve a consumer to employee ratio close to the US average, the savings would approach RS 1.9 billion per year.

Table 2.9: IESCO/US cooperative performance ratio comparison

Category/Performance Indicator	IESCO	US Cooperative Ave
Liquidity		

Current Ratio	1.2	1.6
Amt. over 60 days/Oper. Rev. (%)	2.0	0.23
Profitability		
Return on Assets	8.98	5.07
Op. Rev./km line (Rs.)	1,452,783	1,528,519
Consumers/km line	45	8
Consumers/Employee	154	467
Main Exp./Op. Rev. (%)	1.02%	7.98%
Op. Exp./Op. Rev. (%)	5.45%	7.03%
Cost of Power/Op. Rev. (%)	86.17%	70.55%
Plant Utilization		
PRR (one year Plant rev. ratio)	3.8	6.3
Total Plant/km line	729,886	2,622,327
Solvency		
Equity/Assets (%0	33.1%	42.4%
Long term Debt/Ttl. Capitalization (%)	11.3%	52.0%
Line Loss (%)	9.8%	5.0%
Elec.Sales collected/Elec.Sales billed (%)	94.3%	N/A
Government	83.2%	N/A
Non-government	98.4%	N/A

d. Commercial

i. Overview

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

ii. Summary of Key Findings

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

- **Commercial procedures—** Prescribed procedures are the same for all DISCOs. These were written in the 1980s for a manual system aided by a COBOL computer program for bill calculation. They were adequate for the technology in existence at that time, but now need to be updated. Procedures are inconsistently followed, negating the checks and balances designed to prevent errors of omission and commission.

- **New service connections—** Several factors designed to minimize mistakes in the data entry into the CIS unfortunately contribute to significant delays in consumer billing – sometimes for several billing cycles. 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 the area of meter reading**.** Commercial management and employees indicate there is insufficient time to perform the randomized evaluations of meter reading accuracy supposed to occur. Many meters are not read and readers estimate the reading. Moreover, review of meter reader logs revealed that readers do not consistently identify and record problems with meters. Further, IESCO does not employ a practice to remove, clean, and calibrate meters. The company has a program to eventually replace the electromechanical meters with electronic meters, but about 85% of IESCO meters remain electromechanical.

- **Bill preparation—** The billing process involves manual data transfers and data entry, which often cause delays. Data entry for 6000 meter reads requires a full day for the revenue office team, so if one reader is behind schedule, the entire batch is delayed. Dates appearing on the bill are the scheduled and not the actual dates.

- **Bill delivery—**Inadequate time is allowed for bill delivery, with the result that there are instances where bills have been delivered on or even after the payment due date. The billing timeframe is very tight, meaning that delays in any part of the process will result in delayed delivery of bills to the revenue office where the bills are sorted and delivered to each subdivision. Delivery of bills is often by hand, so lack of transportation also routinely delays bill receipt and payment. It is not uncommon for bills to be left at a central location for all customers in the area.

- **Bill adjustments—**Adjustments to consumer bills can be made at any center, but the bill must be returned to the consumer's division office for approval and data entry. Since there may be a substantial time lag in processing the adjustment, the consumer may have to return to the billing center for another 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 requiring frequent, manual intervention. For pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. The revenue office reconciles stubs and scrolls; this usually takes three-four business days. The bank will not accept payment amounts less than the amount indicated on the printed bill. IESCO is working with banks to have them scan and send customer payments directly to computer real of the revenue office .

- **Disconnection/reconnection—**While IESCO'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. Many disconnections are avoided as SDOs begin contacting customers to remind them that the payment now past due. as soon as the due date passes. IESCO reports that no equipment removal orders were outstanding at the end of November 2010.

- **Customer service**—Consumers can call in their complaints to the customer service centers. At the local levels only the SDO and XENs cell numbers are available. Should the customer receive no satisfaction, his takes his complaint to WAPDA or the ministry; it is then referred back to the customer service center located at the headquarters complex. Many local complaint centers are open 24/7.

- **Meter maintenance—**Meter inspection, testing, repair and replacement are inconsistent at best. Established procedures are not followed, documentation not completed, and handling of meters haphazard. Management of meter assets would be much better served by enforcing existing guidelines. By order of PEPCO, defective meters are not to be used but destroyed.
- **Advanced meter reading—** IESCO begun a pilot project with Automated Meter Readers (AMRs) placed on 367 revenue meters to determine transformer losses. The meters are for readings only and do not have disconnect relays. There are no results as yet.
- **Theft control—**Theft of electricity and related fraudulent activity that reduces revenue to IESCO is rampant and varied in its manifestations. Many instances appear to involve company employees. Reconciliation of customer meter readings to known area meter readings, which would highlight areas for investigation, has not been implemented.
- **Meter integrity and meter reading practices—**When a meter is declared defective, the consumer is billed on the average consumption of the last 11 months. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer. Since it takes 3-4 months for the meter to be replaced, the air conditioning season is over before the consumer is billed on actual consumption again. Many defective meters remain in the field undeclared. Also, with many meters located 7-10 feet above ground, it is difficult to detect meter tampering.
- **Information technology**—Presently IESCO's business processes are characterized by manual and cumbersome practices, inadequate controls, insufficient commercial focus, limited transparency, and lack of reliable information. The use of information technology to improve efficiency and effectiveness has not yet proven successful. Several standalone applications are not integrated either with other applications or with potential applications to be deployed in the future. Although the level of deployment of IT varies significantly from one DISCO to another, the key applications so far 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. As IESCO moves to an ERP environment, the opportunity to rationalize and update core business processes should be a prerequisite for increased automation.
- **Consumer Census**—IESCO conducted a consumer census during the month of December using its own workforce (meter readers and technical staff) and prefilled forms. To make these employees available for the census, all meter reading was suspended for the month.

iii. Analysis & Discussion

The commercial revenue cycle in the DISCOs, including IESCO, is governed by three documents:

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

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

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

The Act also led NEPRA to prepare the Consumer Service Manual that provides instructions and a code of conduct & procedures for dealing with the consumer. 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 & delivery, and resolving complaints are all addressed in this document. It also includes safety and conservation tips for the consumer. The frequent clause "DISCO to insert its name" means that all utilities are to follow the policies stated, and are not encouraged to develop their own Consumer Service Manuals, but use the standard NEPRA guidelines.

Overview of Revenue Cycle

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

New Connections

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

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

IESCO is very efficient at the start of the process. Within a week of receiving a consumer application, the subdivision has conducted the site survey to determine if there is available power, and prepared 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. The consumer has 30 days to pay the demand note at

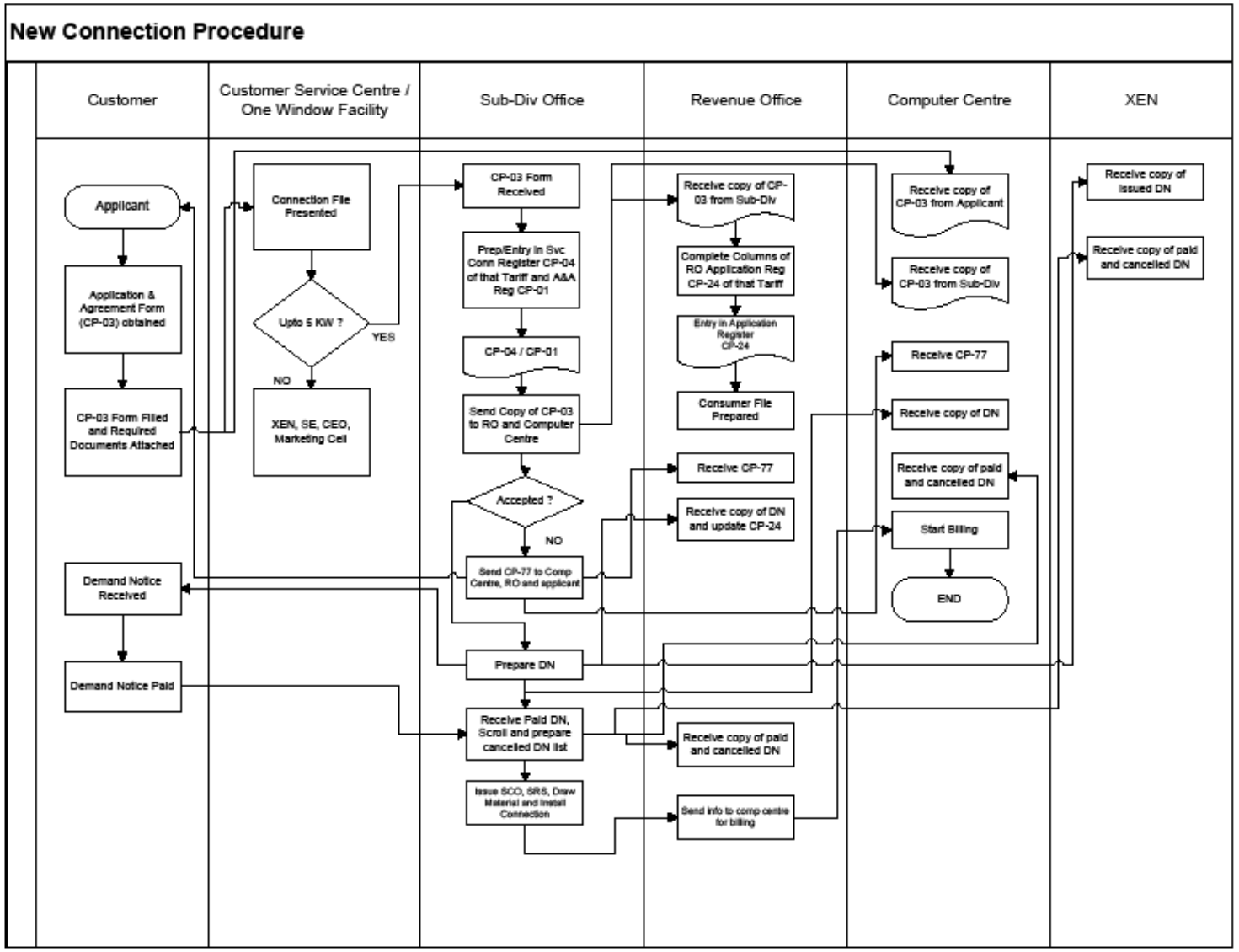
the pay point specified. Once payment has been made and the subdivision office notified, the consumer is added to the queue for new connections.

A Connection Service Order (CSO) is prepared after the fees are paid. The meter, cable and necessary materials are drawn from stores, and the connection installed. Frequently, the consumer signs the CSO to signify the connection is complete. Either way, a copy of the CSO is sent to the divisional revenue office. In the urban areas, the general consumer is connected within a few weeks of paying his demand note.

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. For example the preparation of documentation needed to include the new consumer in the billing system is low priority for the technical personnel. In some cases, newly connected consumers have received service for more than a year before receiving the first bill. Even if the CSO is transferred immediately, it generally takes IESCO two months to process the first bill.

The delay in billing the consumer is the result of the process, which is as follows. First, the revenue office prepares an input sheet of customer data. This information is sent in electronic format to the billing center. The billing center then prints a "pre-bill" listing so the revenue office can verify the data is correct. If the data is not correct, the errors are corrected, sent back to the billing center, and a pre-bill printed again. Once the data is verified and accepted as correct, the first billing cycle may have passed. Because the meter reading list is prepared days in advance, the new consumer may have missed the first billing cycle by a matter of a few days. Fig 2.6 illustrates the new connections procedures

Figure 2.6 New Connection Process



Meter Reading

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

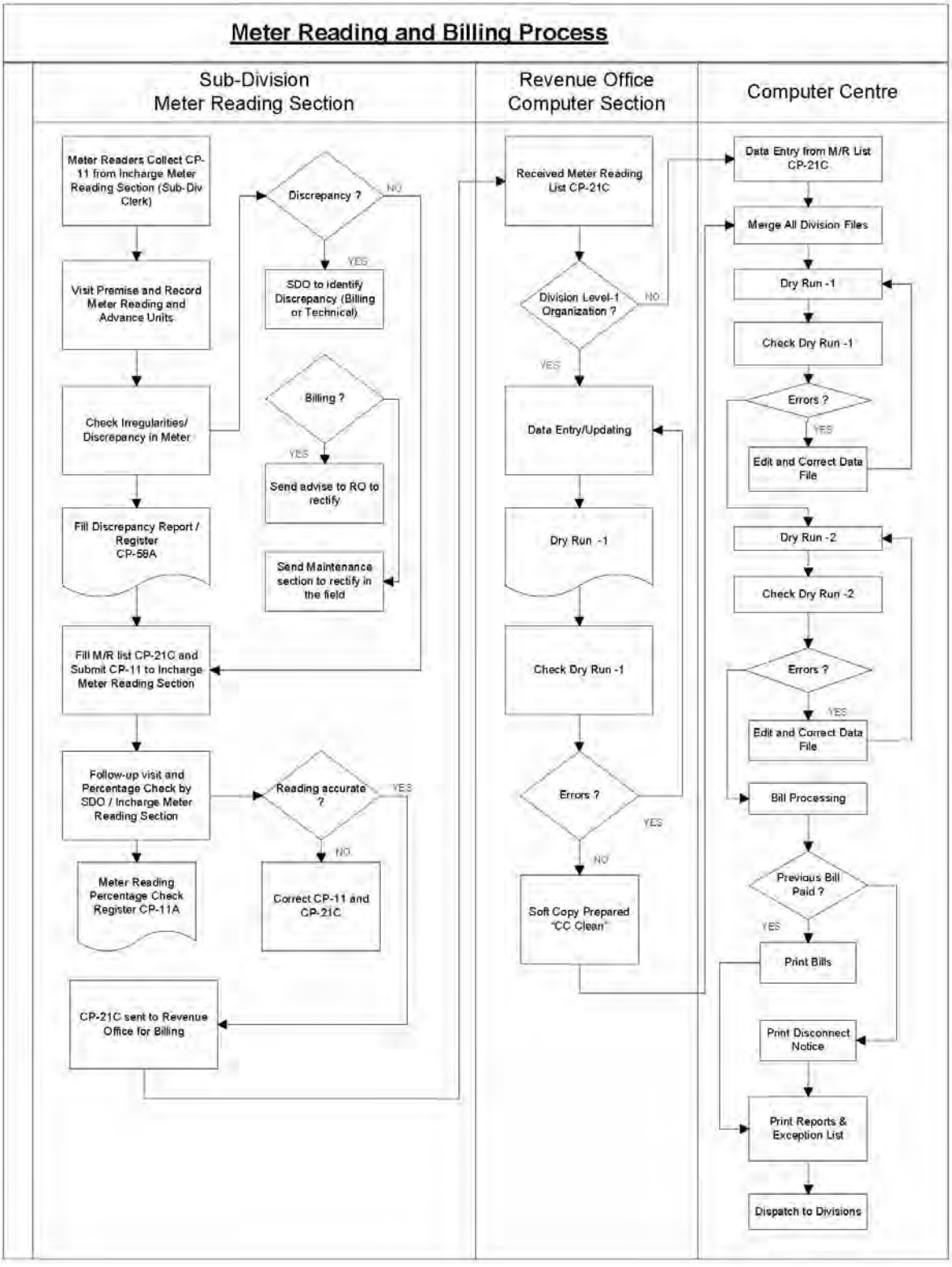
There are a variety of strategies that can be employed to address problems with meter reading, including auditing meter readings; rotation of meter reading employees; outsourcing meter reading services; use of advanced metering technology including automated meter reading, and/or use of pre-paid meters.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

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

Figure 2.7 below illustrates the meter reading, data processing, and billing processes as described by IESCO 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 further shows that the Subdivision Officer is also responsible for performing random checks of meter readings values to determine if there are issues with particular meter readers. Thus there are formal checks in place to detect both meter inaccuracy and meter reading fraud.

While these measures have been designed into the IESCO/DISCO system, interviews with utility commercial staff and record sampling indicate that in fact there is little or no evidence that these procedures are actually followed in all subdivisions. The IESCO personnel interviewed indicate there is insufficient time to perform the randomized evaluations of meter reading accuracy; and review of meter reader event logs revealed that readers are not consistently identifying problems with meters. Furthermore, IESCO does not employ a practice to remove, clean, and calibrate meters. IESCO has a program to eventually replace the electromechanical meters with electronic meters, but about 85 % of IESCO meters remain electromechanical.

Figure 2.7. Meter reading and billing cycle process diagram.



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

The company uses 20 batches to manage the meter reading and billing cycle for general consumers. These batches are read by the regular meter readers. An additional 5 batches are for industrial, tubewell and other large consumers equipped with demand meters read by the subdivision officer or the division executive engineer. Included in these batches are general consumers with loads greater than 5 kW and with time of use meters. These are also read by subdivision senior personnel.

The reading list for each batch is supposed to include consumers on the same feeder. However, this is not always the case. Commercial officers stated that exceptions are made where feeders intersect; it is more convenient for the readers to read the meters on adjacent feeders when already in close proximity to them. When possible, the size of the batch is based on the number of readers and the "yardstick" of 2,000 meter reads per month for urban areas. However, because IESCO has been adding a significant number of new consumers, it is possible that the size of the batch for a subdivision exceeds the yardstick and it may not be possible for every meter to be read every month.

The billing center has the aim of delivering meter reading lists to the revenue office 5-7 days prior to the scheduled meter reading date. Therefore, the reading lists may be prepared 8-9 days before this date. The lists are delivered to the division office and then distributed to the subdivision offices. The lists maybe distributed to the meter readers 3-5 days after the reading date. However, the readers do not use the reading list while reading the meters. Readings are recorded in a "Kalamzu book" (meter reading book) and then transferred to the reading list at the end of the day.

The reading lists contain the consumer number, his tariff code, the previous read, and the consumption for the same month in the previous year. When transferring the current reading from the Kalamzu book to the meter reading list, the reader also calculates the consumption. If the consumption is out of line with the previous year's consumption, the current reading may be adjusted.

Because the reading lists contain the consumption of a prior period, the reader and/or management can adjust the reading so that the consumptions are comparable. The purpose of calculating the consumption is to prepare a check for the data entry of the readings. The process of meter reading and preparing the meter list may take 2-3 days.

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

Bill Preparation

The meter reading lists from each subdivision are passed to the division's revenue office. The transfer process usually requires another day or so. The revenue office enters the readings and consumption for all subdivisions under its control. The consumption data serves as a check for data entry, since warnings are issued if the consumption entered does not equal the consumption calculated by the computer. Normally the revenue offices are managed by two data entry clerks and a supervisor who enter all consumer data for transfer to the computer center in addition to the readings. The clerks work in shifts in order to get all data entered in a timely manner. As noted, data entry for 6,000 meter reads requires a full day for the revenue office team, so if one reader is behind schedule, the entire batch is delayed. The data is then transferred to the billing computer center either by email or delivered to the center by flash

drive. The data for B3 and B4 industrial consumers (the largest consumers on the system) is entered at the computer center.

If closing for the previous month has not been completed, bill processing will be delayed. If all batches with the same number have not been received from all divisions, bill processing may also be delayed. Not every division sends electronic data files, and the data must be entered or digitized by the computer center. Therefore 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 data entry.

The issue date on the bill is not always the date when the bill is printed. However, the due date on the bill is calculated from the issue date—normally 9 days from the issue date for general consumers. Maximum Demand Indicator MDI batches have a scheduled due date 14 days after the issue date. The schedule allows 2-3 days from the print date for delivery to the revenue office. If the bills are not issued on time, the consumer does not have the required 7 days between receipt of the bill and payment due date.

The billing program being used by IESCO was written in COBOL in the late 1960's. Since the code was originally written, revisions have been introduced to improve functionality for maintaining customer balances. Printing of bills and reports is done in SEQUEL. The database is designed exclusively for electricity billing activity. However the COBOL program will not allow IESCO to include other revenues in the bill or track security deposits.

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

There are 25 billing centers throughout the country. A DISCO may have 1 to 5 centers; IESCO has 1. Customer service centers are connected via internet to the system so that duplicate bills can be produced. The customer service has no access to customer history, merely to the current bill.

Bill Delivery

The due date should be calculated from the bill print date with an allowance for delivery days. The consumer should have at least 7 days from receipt of the bill to effect payment to IESCO. However, the due date is usually the target date prescribed by standard IESCO 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.

Usually, DISCO personnel are responsible for bill delivery but the process is outsourced in some cases. Bills are hand delivered to urban consumers. Because transportation is not provided, the bills for some areas may be left at a single location, with the consumers responsible for collecting them from pre-defined central locations. This introduces another source of risk to the bill delivery process.

Bill Adjustments

Bills can be adjusted if required at the customer service centers. If the adjustment is for less than 250 kWh, the customer service representative (CSR) has the authority to make adjustments immediately.

Adjustments in excess of this require verification by field personnel. The CSR may also authorize installments of two to three payments, provided the amount is less than Rs. 20,000. When bills are not delivered on time, the CRS can approve an extension of up to 3 days. All other adjustments will require the approval of the SDO, XEN or DCM depending on the amount of adjustment.

Due to the fact that meter readings are, on occasion, estimated rather than read, actual readings in subsequent months can have the result of pushing some consumers into a higher tariff block. The consumer's bill may be segregated into several periods to lower the total bill, allowing the consumer to avoid the higher slab rates.

Adjustments to consumer bills can be made at any center, but the bill must be returned to consumer's revenue office for data entry. The problem that may arise is the time required to deliver the adjustment to the consumer's revenue office and the time the adjustment is actually entered into the computer. If there is a substantial time lag, the consumer may have to return the next month to the billing center for another billing adjustment. In other words, the back office procedures do not follow through with actually adjusting the consumer records.

Payments

Payments to IESCO can be made at any of the banks that have teller arrangements with IESCO, at local post offices, at NADRA kiosks, or may funds be made electronically. Twenty-five percent of the consumers pay at post offices; another 29% use NADRA kiosks. The majority of funds (57%) are received through 5 banks. NADRA and the post offices account for another 19%, and the remaining 24% are from 35-40 banks.

As payments are received, the pay points prepare a scroll documenting the customer account and the amount paid. If the banks have online facilities the customer information may be transferred electronically to the computer center. However, the posting of payments is not made until the documentation is received. For those pay points without online facilities, scrolls and payment stubs are physically transferred to the revenue office. The revenue office reconciles stubs and scrolls; this process usually takes three to four business days.

The bank will not accept payment amounts less than the amount indicated on the printed bill. If the bill has been adjusted by the utility, the billed amount is adjusted, with the adjustment written on the bill. However, since bills are bar coded, adjustments require manual intervention when scanning the bill for data entry. The barcode includes the due date and adjustments the amount paid if payment is received after the grace period.

The payment stubs and scrolls are transferred to IESCO on a daily basis in most cases. The money is transferred to IESCO's collection account. The timing of fund transfer is dependent upon the agreement with IESCO and the pay points. The transfer is usually at the end of the day or the next day for all pay points except the post office.

Daily postings to the consumer accounts are balanced with the bank scrolls (receipt logs). Banks provide a weekly statement of amounts collected. The revenue office of the division will reconcile the statement with the office copies of the bank scrolls. Reconciliation problems include incomplete / incorrect account numbers, wrong amounts listed, addition errors, etc.

IESCO is working with banks to enable the bank to scan the receipt upon payment from the customer. This is intended to reduce the amount of time required to post the customer payment to his account, a request of many SDOs to have faster payment information so as to better manage the "dues."

Disconnection/Reconnection
The billing/collection program automatically prepares a list of delinquent consumers who are subject to disconnection through an Equipment Removal order for all consumers who have not paid their outstanding balances within the grace period. The list is reviewed and edited by the revenue officer. The revenue officer has the authority to selectively delete consumers from the list, and those Equipment Removal Orders are cancelled.

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

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

Many disconnections are avoided as the SDOs start contacting customers as soon as the due date passes. Because of this effective practice, it is necessary for the SDOs to have access to customer payment information as soon as practical. IESCO reports that no equipment removal orders were outstanding at the end of November.

Customer Service
Consumers may lodge complaints at the Central Control Center, any of the Customer Service Centers including the mobile service center, and at the subdivision offices. The complaints are registered in log books according to type of complaint. The customer service personnel have the authority to adjust consumer bills up to 250 units (kWh), to provide installments for bills less than 20,000 rupees, or extend the due date for three days. The change is entered onto the bill and the customer is free to pay his bill. The adjustment must be sent to the concerned RO office for approval and data entry.

At the local levels, there are no dedicated customer service representatives. The centers/complaint cells are open 24/7 and are frequently staffed by ALMs and linemen.

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

The schedule of power outage in case of load shedding or maintenance purposes is published on the web site. However, many consumers do not have web access. This lack of information causes frustration and loss of time & money for the commercial sector. Telecom operators could be queried about offering an SMS broadcast solution, whereby each of the consumers who has provided his/her mobile number to

the DISCOs will receive an SMS for such outage. Airlines have adopted similar systems with some success.

Commercial department organization

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

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

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

The revenue office is headed by the Revenue Officer and is organized into 4 main sections as follows:

- Accounts Section: headed by the Divisional Accountant responsible for: managing the cash book & its reconciliation with the weekly bank statement; reconciliation of debtors' control accounts; accounting matters under procedures laid down in the Divisional Accountant's Manual.
- General Section: headed by the Commercial Superintendent responsible for: receiving duplicate copies of certain specified application forms & other connection documents from the sub-divisional offices; maintaining connection application registers & files for each consumer.
- Billing Control Section: headed by the Billing Control Supervisor responsible for: controlling meter reading & data delivery to computer center; ensuring billing is correct; making adjustments to inaccurate or incorrect bills; issuing disconnection notices; preparing certain management reports & statistics; bill dispatch.
- Debtor's Control Section: headed by the Debtor's Control Supervisor 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 impact of changes to IESCO commercial practices.

Analysis of Changes in Revenue Cycle Practices

During the month of November 2010, Rs. 4.7 billion was collected. If the collection period were reduced by just 10 days, Rs. 13 million could have been generated assuming an annual interest rate of 10%. Potential savings accrued from improved meter readings are yet more substantial, and if there were a better mechanism matching new connections, there would be an increase in revenues with an increase in customers billed. Consumers are not billed when the billing center fails to receive notice that a consumer has been connected or reconnected. In many cases, the consumer is billed after a period of delays, and the utility makes concessions by allowing installments or even writing off a portion of the bill.

As noted, the revenue system could work more effectively if its practices and procedures were implemented with greater discipline and efficiency. However, it is the undocumented transactions (a.k.a.

administrative losses) that cause concern. The calculation of technical losses and energy accounting would allow a better reconciliation of deliveries and amounts billed. Detailed analysis of this aspect of losses is given in the Engineering section of this report. Comparing the energy delivered during the calendar month to the energy billed during the same period is not energy accounting. The delivery and consumption must be in the same period to determine the true losses.

Because there is such reliance on the meter reader in the revenue cycle, more rigorous controls and oversight are required of the meter reading cycle. It is impossible to assert effective transactional control if there is collusion between the meter reader and other parties in the revenue cycle. The comparison of meter readings with the readings recorded in the Kalamzu book may provide some oversight. However, manipulation can occur while preparing the reading lists used for billing purposes. The preparation of meter reading lists can be eliminated altogether through a change in technology – or by a combination of changes such as automated meter reading with handheld devices.

Distribution losses can be hidden by adjusting consumption of selected meter reading upwards. The addition of consumption to various consumers, or delayed readings, can be used to manipulate revenue and allow managers to meet performance targets. Some of this manipulation may be uncovered during data entry. But with the addition of automated meter reading, the data is uploaded to the billing program eliminating the need to enter it manually.

Meter routes should be organized around metered transformers and all of those meters should be read on the same day. The transformer number should be made a part of the customer record to calculate allocated load and total energy consumption at the transformer level. Meter reading of the transformer meter, if installed, can provide a sound base for energy accounting and transformer load management. IESCO's recent consumer census is a step in the right direction.

A reconciliation of energy needs to be made for each transformer to determine the reasonableness of the energy billed. If it is not reasonable there may be theft, meters missed or recorded incorrectly, or a problem with the system.

To prevent newly connected/reconnected consumers going unbilled for several periods, logs of prepared service orders and status should be kept and reported. Service orders should be in duplicate and copies sent to the revenue office, which should be responsible for follow up when an order has not been cleared within a reasonable time. Reports of completed connections should be made and entered into the billing system as they are completed. When a meter is reported defective it should be replaced immediately. If the utility had its own meter repair and calibration lab it would be possible to fix it, recalibrate it and place it back to stores to be reused. If it is not economical to repair the meter, it should be dismantled for spare parts for use in future repairs.

If the customer can be given a reasonable level of service, he may not find it necessary to achieve his electricity through dubious means. IESCO has better control of its system than most DISCOs, and many dangerous situations have been eliminated. The increase in consumer satisfaction has resulted in more consumers paying their bills regardless of the "outlandish" tariff rates.

Meter Maintenance

Meter surveillance is done by the M&T teams. They primarily check meters of industrial and bulk consumers. Random testing of general meters is not done. Industrial meters are tested every six months. The testing procedure is performed in the presence of the industrial consumer.

Other meters are tested if a consumer requests a test, the concerned utility employee reports an abnormality in consumption, or there appears to be physical damage. Meters that appear tampered with are removed and kept for evidence. Other meters declared defective are removed and destroyed as per the noted PEPCO ordinance. If the meter slows gradually with age, it will very likely go undetected. Moreover, many meters are located on poles or high on the outside walls of the premises above eye level. It is doubtful that those meters are actually read and any damage or abnormality would go unnoticed.

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

Meter replacement is done if the meter is reported defective. A defective meter log is updated by the meter reader. The logs that were reviewed revealed that the entries are not numerous; defective meter logs may not be kept in some subdivisions. It may take several months to replace defective meters, and there are no reports of how long meters have been declared defective. Someone other than the meter reader should additionally inspect the meters on a regular basis.

Advanced Metering

IESCO has begun, or is about to begin pilot projects using AMRs. The first project installed these on 367 revenue meters. For 20-30 consumers, consumption increased by 6% indicating that meters readers may have previously manipulating reading data. Although details are not available regarding the nature of the test, it is clear that additional steps are necessary to limit manipulation of manual readings. Utilities should treat the meter as their "cash box" and practice effective controls such as reading audits. If the integrity of this "cash box" can be maintained, their commercial losses can be reduced.

The second pilot is a total conversion to AMR on a single feeder. The feeder selected is one that has high loss rates. There are no details as yet regarding the pilot.

To improve the billing process, automated meter reading should be installed not only on the premises but also at delivery points. AMRs will eliminate transcription errors and reading errors; and manipulation of readings on behalf of consumers or management. The data can be loaded directly into the computer system. AMR meters result in real time consumption data provided directly to the utility commercial system. Consumer usage can be monitored from a remote point of access (such as the commercial office).). Modern meters allow reading of a host of electrical data that can be used for technical analysis and understanding of load behavior.

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

Meter Reading and Bill Delivery Practices

Although meter readers are assigned less than 200 meter reads per day, many are not able to read the full complement of meters. They are required to provide their own transportation without reimbursement.

The result is that many "readings" may be estimated or simply falsified. This is a serious problem for the DISCO and for the consumer.

Most subdivisions reported that meter readers are systematically rotated every quarter or six months. 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 the development and sustenance of personal income streams through fraudulent meter reading practices. In cases where meter readers are not rotated, or patronized by trade union representatives, this has led to a further erosion of the 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 may be 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

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

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

Meter readings submitted for billing purposes are reportedly influenced by the management of the divisions and subdivisions in order to meet revenue targets. Some consumers are overcharged because of excess readings to compensate for the under billed consumers. Readings are said to be adjusted to manipulate the slab tariffs to create revenues. Over a period of a few months, the actual meter readings will be correct, but the consumer has been charged at the higher rates which are not fully compensated when the consumption is lowered. Although this tactic could not be objectively verified, the system does allow this sort of manipulation as reported by employees.

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

Meter Integrity and Meter Reading Practices

When a meter is declared defective, the consumer is billed on the average consumption of the last 11 months. Because it is the meter reader that declares a meter defective, it is possible for collusion between the reader and the consumer, especially during the peak season of summer. Therefore, the

reader declares the meter defective and the consumer is billed on the lower estimated consumption. Since it may take 6 months for the meter to be replaced, the air conditioning season is over before the consumer is billed on actual consumption.

With meters located 7-10 feet above the ground, meter tampering is difficult to detect. The quality of service installations too is questionable, many meters being poorly installed. Employees occasionally have to use tools and small parts (screws etc.) furnished by the customer. The meters may also be loose, crooked, etc. and hence difficult to define as having been tampered with.

Customer Information System

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

The following are some examples of inefficiencies/inadequacies:

- 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 IESCO to order materials when needed, and connect consumers on a timelier basis.

- IESCO 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. One significant problem is that the customer account records cannot be updated real time, i.e. the customer bill is revised manually but in many cases the same amount appears as arrears in next month's bill.

- Delayed billing due to non distributed billing/data processing system increases bill processing and bill collection cycles, i.e. the computer center waits for data from all subdivisions of all divisions of all circles before processing.

- Only one month's billing information is available on computer master file, historical data being off-line on tape cartridges. Thus no trend analysis to locate the gray area of business could be performed.

- Delayed cash processing/posting (more than 10 days in some cases) delays the cash reconciliation process. In addition, management receives delayed information.
- Delay by banks in remitting money to company's account due to cash collection policy.
- No historical computerized record of service complaints.
- No computerized system for transmission loss calculation.
- Field staff is engaged in a number of duplicate activities, i.e. maintenance of documents/registers at many levels, copying information from one form/register to another form/register etc.
- Resistance/lack of cooperation from system users to new technologies is a key hindrance towards improvement in customer/utility relationship.

Customer Census

As noted, during the month of December 2010 IESCO conducted a customer census for the DISCO's entire territory. Every customer was surveyed to verify the completeness and accuracy of the customer data used for billing. In order to take the survey in such a short period of time meter reading was suspended, all customers being billed on an estimated basis.

The survey team also added transformer connection information to each consumer. The survey was made by IESCO meter readers and technical staff using prefilled questionnaires. They were paid Rs.20 for each account surveyed. There were allotted only 5 minutes per customer.

Although data entry was only 90% complete at the time of the operational audit, one subdivision reported there were no new connections, but about 200 changes in tariff classification were made. Most changes were in the meter numbers, classification codes, and tariff load issues. Problems were encountered in obtaining ID cards. Frequently the registered customer was not at home, and the ID card of the person providing the responses was taken.

e. Human Resources

i. 2.5.1 Overview

Management and staff interviews held at IESCO have led to the conclusion that while the utility appears to have made significant progress in retailing electric power to its customers, it still faces significant challenges in modernizing its HR policies, procedures, and overall functionality. It has yet to develop a strong and progressive corporate culture, in which management and staff has well-defined responsibilities; where management is endowed with adequate authority and staff has accepted and understood its accountability. For all intents and purposes, IESCO today perpetuates public sector oriented HR protocols & procedures rather than reflecting the values and attributes of a modern, independent, and efficient electric distribution utility. Results of the interview process showed that management was unclear whether it answered to the BOD, PEPCO, or MWP. Partly because of this, governmental and political influence has often been exerted on IESCO's senior management – in turn traditionally selected by PEPCO.

ii. Summary of Key Findings

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

- The challenges facing the HR infrastructure are serious and entrenched, because IESCO has been subject to both internal and external manipulation – by political sponsors, government agencies, trade unions, and by employees themselves.
- IESCO needs to develop a current corporate culture featuring management-employee responsibility & rapport.
- Results of the interview process indicated that management is unclear as to whether it reports to the Board of Directors, to PEPCO, or to the MWP. Partly because of this, outside governmental as well as political pressures are commonly and effectively exerted on IESCO senior management – which is itself selected by PEPCO, not by the Board of Directors. Due to its proximity to the corridors of powers in Islamabad, IESCO faces more of these challenges than do the other DISCOs.
- There is a lack of transparency in hiring and career advancement. Clear and transparent HR-related rules & regulations are lacking, and the Disco needs to foster an atmosphere of fairness and impartiality regarding the annual performance review process.
- IESCO's corporate culture does not reflect a modern, independent electric distribution utility. Employees appear locked into an archaic public sector mindset, where employment guarantees promotion based on seniority, with scant emphasis on 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.
- Salaries are artificially low due to continued adherence to GOP/WAPDA salary scales. While this may result in savings to the utility's operating cost, it is in fact an artificial saving as employees who are perennially underpaid cannot function at peak levels of performance. Experience from other countries shows that low compensation levels can cause both poor performance and corruption in the workplace.
- IESCO has developed job descriptions for certain staff positions, including some for senior management; but the PDIP review has revealed these are not fully updated, lack key accountability/performance indicators, and essentially remain those of the Area Electricity Boards. They do not have clear and specific descriptions of roles & responsibilities; required educational background & professional experience; core competencies; and scope of authority & responsibility.
- IESCO has developed a Human Resource Information System (HRIS) Database for personal information, but it does not qualify as an information system with the planning & reporting capacity to fulfill the needs of a modern electric company. (Manpower analysis, recruitment planning, performance management, web based facilitation etc)
- The utility's Regional and Circle Training Centers lack proper infrastructure, curriculum, training tools, and housing facilities for trainees. While it provides capacity & safety training at a central training center, the linemen trainees are trained with tools not commonly provided to line workers. The line workers are generally not provided basic line tools and equipment required to perform corrective maintenance & 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.
- IESCO's senior management has a vision for the company's progress, 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/ government involvement in hiring decisions.
- IESCO does not employ a corporate performance management system. Instead it uses the standard GOP annual performance review program that is not based upon goal setting and objective evaluation of performance.
- The utility has not yet developed an employee handbook.
- IESCO does not have a comprehensive training & development action plan, and generally lacks training/capacity building programs. Training offered is mostly aimed at allowing employees to advance within the DISCO system, as opposed to skill development. Training facilities are ill-equipped; with instructors not been retrained in many years, and training manuals not updated in two decades or more. The training program also lacks post-training impact evaluation.
- The HR department lacks a structured HR strategy defining goals & objectives in line with those of the company.

iii. Analysis & Discussion

Historic WAPDA recruitment and promotion policies prevail in IESCO as in all DISCOs. There is lack of transparency in employment & advancement processes; with the former often dictated by external agencies such as MWP and PEPCO, and the latter based on seniority rather than performance. Clear and fair HR-related rules & regulations have not been established, nor have the necessary checks & balances required for a proactive annual performance review process. Its corporate culture has not evolved into that of a modern, independent electric distribution utility. Both management and staff appear frozen in this archaic administrative structure that requires urgent and sustained reform and redesign..

IESCO's multiple challenges of commercializing widespread energy distribution, managing capital resources to finance system expansion & maintenance, upgrading its billing & receipts structure etc. requires professional HR, management, technical and other skills/experience. As noted, while the past two to three decades have seen substantial system expansion, internal infrastructure has remained static.

IESCO's need for a clear, proactive and structured training & capacity building program requires to be addressed on a priority basis. Likewise the development of a customer oriented approach to build trust and confidence in its consumers.

Overview of IESCO Corporate Culture and HR Environment

However, with regard to geographic location, serving among other districts the federal capital; IESCO appears more dynamic in its dealings than the other DISCOs. Its senior management was very clear, through repeated emphasis, on the need to be autonomous and free from government control and political interventions.

The HR Department was not significantly involved in improving the entire organization. Its overruling responsibility is covering organizational development, capacity building, and performance management systems. Department management and staff are limited at the corporate level; and circles and division offices do not have HR representation. To maximize HR support and employee relations, HR representation should reach down to the circle level.

During the assessment, the PDIP team found a large number of employees de-motivated. IESCO can improve its HR environment by strengthening the Department with specific HR inputs to enable its proposal of relevant planning strategies with support from senior management.

Modern HR Practices

Throughout IESCO staff at all levels stressed the need for fair and transparent HR management and operation, the absence of which underlies most of the utility's problems. As noted, the need for accurate job descriptions, key performance indicators, and objective appraisal systems is crucial. This is necessary to establish the foundation of a progressive business entity. According to our assessment, IESCO's current HRIS is limited to a simple personnel database and marginal querying capability.

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

1. Job descriptions complete with educational requirements, and total professional experience for all positions in the company.

2. A fair and transparent hiring process that allows 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 should be applicable to all positions.

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

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

Analysis of Manpower:
Long-term performance improvement will require significant changes in HR management and capabilities. A review of manpower human resource statistics was undertaken to understand how resources are allocated, and how well-prepared IESCO employees are to meet the requirements of their positions. Table 2.10 below summarizes the manpower statistics. It shows that only 3.6% of IESCO staff is university graduates; about 35% of the workforce is virtually illiterate; and less than 0.5% is women.

Table 2.10 Manpower statistics

Manpower Distribution	**Strength**
TOTAL	**13,674**
Total Officers	**365**
Total Officials	**13,309**

Regular Employees	**12,071**
Contractual Employees	**1,383**
Daily wages Employees	**220**
University graduates	**498**
Secondary education	**8,271**
Primary & complimentary	**1,537**
Others	**3,368**
Female	**67**
Male	**13,607**

Source: IESCO HR Department "Data as of Jan 15th, 2011"
**The Data acquired in this assessment might vary from the data reflected before June 30th, 2010, due to manpower sizing, attrition, etc.*

Table 2.11 shows that a significant number – approximately 16%, are not properly categorized by occupational streams (those shown as "Others (schools, civil works etc.)", and are not employed in the core utility business. This trend has been observed at other utilities as well, although the IESCO numbers are significantly lower than at other DISCOs. However, this leads to the conclusion that IESCO has either not assigned employee to positions relevant to meet its needs, or has become an employment center that pays for services not required. Thus it is very likely that many services could be effectively outsourced.

A detailed study will be necessary to carry out long term manpower planning, with the objectives of an educated employee workforce, officers having business and management skills, and a substantial intake of women.

Table 2.11 Distribution of employees by department

Employees by Department	**Strength**
Executives/ Directors	**30**
Human Resource Department	**22**
Finance Department	**80**
Operations Department	**9,157**
Commercial & Sales Department	**545**
Administrative Department	**20**
IT/ MIS Department	**81**
Health & Safety Department	**52**
Construction Department	**836**
Training Department	**85**
Audit Department	**98**
Security Department	**368**
Others (store, school, civil, other)	**2,300**
Total	**13,674**

Source: IESCO HR Department "Data as of Jan 15th, 2011"
**The Data acquired in this assessment might vary from the data reflected before June 30th, 2010, due to manpower sizing, attrition, etc.*

Table 2.12 below provides a snapshot of IESCO employees' time in service. This shows that 54% of the employees have been in service for over 11 years. Therefore a significant number of staff has been in the

legacy WAPDA organization for many years. The demographic distribution shows a reduction strategy will not be able to rely on attrition through retirement alone; other strategies will need to be considered when evaluations of job structure and employment strength optimizations are contemplated.

Table 2.12 Distribution of employees by years of service and age bracket

Year Of Service	Strength	Age bracket (Years)	Strength
0-5 years	**3,020**	**30 and below**	**3,129**
5-10 years	**3,216**	**30-40**	**4,205**
10-20 years	**2,308**	**40-45**	**1,364**
Over 20 years	**5,130**	**45-50**	**2,292**
		Over 50	**2,684**
Total	**13,674**	**Total**	**13,674**

Source: IESCO HR Department "Data as of Jan 15th, 2011"
**The Data acquired in this assessment might vary from the data reflected before June 30th, 2010, due to manpower sizing, attrition, etc.*

Compensation Analysis

A detailed market survey will be required to evaluate market-competitive levels of compensation for IESCO employees. As noted, data collected and evaluated thus far indicates salaries and benefits are far below reasonable levels needed to retain valued employees. During the audit, the PDIP team discovered that IESCO is giving a Hill Allowance to its employees posted in the Murree Circle; employees residing at places up to an altitude of 3,000 feet receive Rs.300 per month, and employees residing at altitudes above this Rs.500 per month. The company has also added certain technical allowances, ranging from Rs.300 to Rs.400 per month, for the maintenance staff in BPS 1 –15. The utility should carry out a comprehensive review of all benefits and establish a standard and uniform structure.

Similarly a revisit of IESCO's allowances, specifically those for Urban and Rural Housing, will be important. The team found out that currently employees residing in urban areas receive higher allowances those deputed to rural formations, effectively discouraging those not native to these areas from working there.

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

Exceptions occasionally occur when personnel are hired on "contract" as DISCO Directors (e.g. of HR, Legal or Finance). The pay package for such employees is considerably higher than for formal IESCO employees, not being constrained by the government BPS.

Private sector employees are paid several times more than DISCO personnel. For example, the CEO of NESPAK earns approximately four times as much as the IESCO's CEO (see Table 2.13). An even more

striking comparison is that a newly graduated engineer hired from the private sector would draw a salary equivalent to that of the utility's CEO.

To arrive at a more definitive answer to the question of desired compensation/benefits package in a private sector entity, the identified market-based survey should be broad in scope and carried out by a professional HR firm under PDIP direction. However such a package will be feasible only when the company is autonomous of government control.

Table 2.13. Comparison of IESCO and other institutional salary levels

DISCO		NEPRA		NESPAK			PTCL
	Rs'000		Rs'000		Rs'000		Rs'000
CEO	108	Chairman /Member	382	CEO		President	Spl. Pkg.
Director / Chief Engineer	108	Director General	338	Exec. VP	278	Exec. VP	425
Mgr. / Superintending Engr.	86	Director	265	Gen. Mgr.	217	Gen. Mgr.	287
Deputy Mgr. / Exec. Engr.	69	Dy. Director	203	Principal Engr.	114	Sr. Mgr.	170
Asst. Mgr. / Sub-Div. Mgr.	57	Asst. Director	140	Jr. Engr.	84	Asst. Mgr.	90

Data Source: "Nepra Accounts Department-- "PTCL & NESPAK HR Department" as of December 30th, 2010.

Organization

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

This arrangement creates an internal conflict within the distribution circle; since commercial operations are the cash register, so to speak, of any utility, the commercial department should not report to the operations department. The operation department manages the operation and maintenance of physical

assets, focusing on power quality and reliability. The commercial operations measure the success of the operation department and therefore must be independent and are best managed by managers and staff that have the educational and experiential background, as well as the institutional objectives aimed at optimizing distinct objective functions. Commercial activities have the objective of effectively managing the process of connecting and/or disconnecting services; metering energy consumption; recording consumption data; billing consumers for energy consumed and other services provided; and, collecting receivables from consumers. Distribution system operations focus on operating and maintaining the distribution system infrastructure, including recording bulk energy transfers into and out of substations; performing substation and line maintenance; and, management of minor system expansion activities.

IESCO's present organizational structure has commercial personnel reporting to engineering managers, and far too many managers reporting to the CEO, whose principal responsibility is to ensure the DISCO's financial sustainability. Engineering planning, operations, commercial, administration, and financial management should all be run on a routine basis by highly competent managers without CEO involvement, other than for setting objectives and reviewing progress towards higher level achievements.

Human Resources Organization and Management

In additional to functionality challenges, the HR Department is faced with organizational issues. The Manager Labor & Litigation currently reports to the Director HR/Administration. It is proposed that the legal counsel's portfolio be upgraded to Director Legal & Corporate Affairs and that he/she should report directly to the CEO.

All HR functions are currently managed in the IESCO head office; there is only one Assistant Manager HR operating in the Rawalpindi City Circle, and no HR representatives at the other circles of IESCO. Basically the utility relies upon administrative staff to manage human resource issues at the circle level, but these employees have no training or expertise in conducting HR training activities advising employees on their rights and obligations to the company.

Given the stated limitations of IESCO's personnel database it needs to institute an HRIS allowing the company to digitize all HR data, reports, personnel files, performance management programs etc. This has become an essential feature of modern HR management systems.

Health, Safety and Environment

The records of the previous three years (table 2.14) show that IESCO has a very poor record of safety in its operations; there have been 8 fatal accidents in the first six months of the current financial year, 18 in 2009-2010, and a total of 42 in the previous 3.5 years. This is attributed to the non-implementation of safety procedures and the unavailability of safety clothing & equipment. The numbers of non fatal accidents are also correspondingly high.

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

Safety is not given is due importance with respect to either for employees or consumers. Safety training/awareness to advise the public on the proper use of electric power – and the risks involved in inappropriate contact with power systems – has not been adequately addressed, nor suitable programs developed and deployed.

An effective safety program will require significant investment in training, protective clothing, tools, and program monitoring. It will require a cultural shift in the workplace, all aimed to dramatically reduce accidents and deaths. In addition, IESCO employees/dependents would benefit from the suggested diversification of health care options.

The health coverage for employees and dependents is poorly structured and involves considerable difficulties for employees. There is no choice for employees and their dependents to obtain medical care (out-patient and in-hospital) of their choice; they are being restricted to use of the WAPDA central hospital or peripheral health care centers, requiring considerable travel, or unequipped with the required facility/services. Alternatives such as better health care through insurance, or paying a fixed proportion of salary for outdoor treatment, have not been evaluated or brought up for serious consideration.

Table 2.14 IESCO Accident rate of last 3 years

Year	Events	Fatal	Non Fatal
7/2010-12/2010 (Last sixth months)	12	08	04
2009-2010	35	18	17
2008-2009	24	11	13
2007-2008	18	07	11

Data Source: IESCO HR Department "Data as of Dec 30th, 2010

Vision and Internal Communication

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

Recruitment

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

As mentioned above, the position descriptions even for the most important jobs in IESCO are not well defined, do not specify core competencies, required educational background or level of responsibility. The position descriptions are too general to be used effectively to guide the recruitment process. The compensation package is certainly well-known within Pakistan, but it is not competitive with similar private sector jobs. There is certainly no inducement for well-qualified candidates to assume key roles within IESCO.

Lastly, the recruitment process itself is often short-circuited by direct appointments made by PEPCO and/or the MWP. This practice violates the concept of an independent electric distribution utility, and has forced IESCO and other DISCOs to absorb employees in 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 selected. From January – December 2010, 820 or 64% of a total 1,288 new employees were recruited through open competition, whereas 468 or 36% were inducted on employee quota. It is important that fair, transparent recruitment policies & procedures must be adopted to ensure quality of HR operations. (Data Source: IESCO HR Department "Data as of Jan 15th, 2011")

Performance Management System

IESCO does not employ a corporate performance management system. In 2009 along with other DISCOs it changed its annual evaluation system from the Annual Confidential Reports (ACRs) to the PEPCO-pattern Performance Evaluation Reports (PERs); essentially perpetuating the previous process weaknesses: absence of goal-setting, objective assessment, or sharing of evaluations with employees.

A robust performance program requires specific job descriptions establishing the performance expectations, core competencies, reporting requirements, and professional demeanor expected of each employee. The process should include goal setting, discussion between employee and supervisor at year commencement, and objective review & evaluation midyear and year end. Advancement should be based on achievement and not merely on seniority.

HR Policies and Procedures

IESCO has not yet developed a consolidated, easily accessible set of HR policies & procedures manuals for management and staff. From recruitment to retirement, clear-cut rules & regulations are required to replace/revise the archaic ones in place and reflect those of a modern electric utility. The longest serving HR resource is usually the one who knows almost all rules and even how and where to find them. Staff, particularly from outside the HR department are, therefore, greatly disadvantaged, because they are dependent upon the Department even for small things, such as leave regulations, etc. In such a scenario, fair HR operations that are transparent and equitable don't take place. Where policies or procedures do exist there is an inadequate implementation, allowing the intrusion of influences internal and external.

Employee Handbook

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

Training and Capacity Building

Like the regional training centers (RTCs) at many DISCOs, the IESCO RTC in Islamabad requires substantial rehabilitation, in terms of both the building and training materials. The RTC is currently housed within the large WAPDA Staff College in Islamabad, but without the necessary space to function as an independent training center. Based on visits to the facility and discussions with training staff, it is clear that training tools, manuals, & other aids are inadequate to meet the growing needs of the utility. For instance, linemen are trained with tools not commonly provided to the line workers. The line workers are in general not provided basic line tools & equipment required to perform corrective maintenance and line operations in a safe, effective manner.

IESCO does not have a comprehensive training and development action plan and generally lacks training or capacity building programs. The training that is offered is mostly targeted to allow employees to advance within the organization; that is preparing employees for promotions. Training is not really oriented towards substantive skill development. IESCO has not designed or implemented an effective needs assessment plan which is needed in order to design future training programs. The training facilities are ill equipped, with instructors who have not been retrained in many years, and with training manuals that were developed in the 1980s (under a USAID program) and have not been updated since then. The training program also lacks a program to perform post training impact evaluation.

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

Commercial training:

1. *Meter reader training.* This should focus on familiarizing meter readers with new metering technologies: to use handheld electronic meter reading devices; to identify & record meter faults, meter tampering, and meter maintenance requirements; and to ensure proper orientation in carefully recording & transcribing data.

2. *Improving basic computer skills for commercial staff.* This would dovetail with basic IT and ERP implementation, to ensure that commercial staff understands how to specifically manage new levels of responsibility using ERP screens & troubleshooting functions: modifying customer information, printing modified bills, and other basic tasks associated with advanced commercial customer information and billing program. (the training on using ERP will be planned and imparted only when IESCO actually go on ERP)

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

Engineering & Operations training:

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

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

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

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

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

Finance & Accounting

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

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

Human Resource Management

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

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

3. *Annual performance evaluation program design and training.* To familiarize employees and staff with the performance evaluation program.

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

f. Communications and Outreach Assessment

i. Overview

IESCO) is one of the eight distribution companies which emerged as a result of restructuring of the power wing of WAPDA. At present, IESCO is providing electricity to approximately 2.1 million consumers – out of which more than 1.6 million are domestic and around 255,000 are commercial. The total number of industrial consumers is approximately 12,000. It anticipates a revenue of Rs.75-80 billion during the ongoing fiscal year.

ii. IESCO's operational region, known as the Potohar, is mainly a hilly area where the water-table is deep and therefore agriculture largely pursued on seasonal rainfall. A large section of this population is settled in Europe, the UK and the US. Most residents work in government departments, serve in the military, or run their businesses. Two military garrisons are based in the operational area of IESCO. The federal capital is also under IESCO's jurisdiction, giving a special status to the DISCO. Salaried consumers living in such regions are considered 'better consumers,' providing the utility with a solid base for its relatively positive performance, enhanced by its conscientious management.

For a utility organization like IESCO with such widespread operations, assuming a service delivery role and achieving customer satisfaction becomes a major challenge. A well-crafted communications and outreach strategy can play an important role in maintaining its robust relationship with internal and external stakeholders, as well as building the strong and credible image of a corporate entity. However with continuous power outages, tariff hikes and the complex nature of power sector reforms, IESCO's role is constantly challenged. On one hand, it is confronted with a complex task of redefining itself as a corporate entity –a role which is still dominated by PEPCO and MWP–and on the other it is constantly struggling to encounter consumer fatigue due to persistent shortfall of electricity.

With this background, a communications and outreach assessment was conducted to identify key areas for interventions to strengthen and sustain a coherent corporate image for IESCO with its stakeholders.

iii. Summary of Key Findings

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

- **Internal Protocols and Practices of Communication:** The organizational culture follows outdated practices of internal communication, resisting the process of transition to a modern, service delivery organization.

- **Corporate Communications and Consumer Outreach:** External communications and public outreach have been extremely restricted and not considered a priority. As such the company undertakes external communication only at the local media level and with very limited scope.

- **Public Relations Department:** The PR Department is relegated to the administrative role of issuing press information. With no authority, the section lacks institutionalized structure and decision-making capacity and therefore operates in an ad hoc manner.

- **Low IT Penetration:** IT penetration at IESCO is minimal, the management itself lacks computer literacy. Utilization of modern communications technology and across-the-board training for this is imperative for the successful transition to cutting-edge communications capability.

- **Media Mix and Products:** IESCO's outreach remains limited to press releases, shut down, procurement notices, and the occasional energy conservation awareness message. The website is not maintained or upgraded, nor is the potential of the web portal explored or utilized. There is no Annual Calendar of outreach activities, either internal or external.

iv. Analysis & Discussion

With over 13,000 employees serving in different job categories ranging from line-superintendents to managerial staff and executives, IESCO stands at a crucial transition point where efficient communication is essential to its success as a utility supply company. However, as observed, despite its progressive corporate aspirations the company's public sector status quo has continued.

IESCO has yet to take several concrete actions – both internally as well as externally – to foster an organizational vision of becoming a primary 'integrated power supply' utility in Pakistan .The absence of proactive communications and outreach has been one of the bottlenecks barrier in this regard. From laborious inter-office protocols to passive contacts with the end consumer, the company is pursuing conventional rules of engagement with internal staff and external consumer alike.

Moreover, despite being mandated as an independent distribution company, IESCO continues to experience the overriding involvement of PEPCO and MWP, further curtailing its operational and financial ability to control mass media campaigns through its PR Department.

With a fair degree of acknowledgement of all these limitations, the communications and outreach assessment was conducted to review the efficiency and effectiveness of both the internal and external communications of IESCO. The results are discussed as under.

Internal Communication Process, Protocols and Practices

IESCO has been operating as a corporate entity since 1998. However, it still follows the traditional bureaucratic process and procedures for internal communication. In the age of ICT convergence, the formal communication in IESCO still relies on obsolete modes of letters and memos forwarded through inter-office files, personal delivery, fax and post mail. The letters are usually delivered in person within head office and through normal post, fax or special messengers in the city and outside city.

Circular notices and departmental and inter-departmental meetings are also common tools of internal communication. The information regarding developments in the organization, career-related news, updates, and staff welfare activities are communicated through the letters, notice board, website – to very limited extent – and through word of mouth. The employees mostly rely on traditional "file culture", limiting the scope of prompt and clear communication in most cases. Clarity, creativity and decisive communication are the ultimate causalities as a result of such practices. Absence of a well-equipped communication structure and lack of capacity to use modern tools of communication among the

employees, and traditional mindset are the major challenges with reference to intra-department and inter-department communication.

IESCO's website is maintained by the MIS department and the Public Relations Officer (PRO) has no role in the development of content, messages, and designing of the website. The website seems to be an effort to provide a platform for internal communication; nevertheless, it has not been utilized effectively for this purpose. Top management has computers and broadband internet access; however these are operated mostly by their staff. In many cases computer literate "lineman cadre" personnel have been appointed as ad-hoc computer operators. Usage of modern communications technology and across the board training for such tools was observed inevitable for a corporate shift to a more efficient, prompt and clear communication.

The few outreach activities reported related mainly to staff gatherings on special occasions such as farewells for retiring employees etc.

The Public Relations Department:

The PRO at IESCO, like at other DISCOs, is responsible for interacting with the media and promoting the utility's corporate image. The department prepares and disseminates messages with the approval of the CEO. Having no dedicated budget for external and corporate communication, it uses the budget allocated by other departments for advertisements and tenders. The staff comprises one deputy manager (a computer graduate), one assistant manager and two Lower Division Clerks (LDCs), one cameraman, one stenographer and one Under Division Clerk (UDC). The PRO undertakes the following functions:

1. Scan six Urdu Dailies & four (04) English Dailies, and prepare a summary for CEO of any material published regarding IESCO in particular and the power sector in general. In addition to the above newspapers, the PRO also scans five local papers.

2. Respond to media with clarifications if desired by CEO.

3. Prepare and issue press releases on IESCO activities, public notices, procurement notices, shut down announcements etc. These are prepared on computer and communicated by email/fax.

4. Liaise with local press and electronic media for clarifications and media coverage. National media campaigns are managed by PEPCO.

5. Liaise with designated advertising agencies – MIDAS and TIME & SPACE – for preparation of press and electronic media campaigns and media responses.

6. Manage compilation & publication of monthly newsletter i.e. *IESCO NEWS*. The newsletter is mainly prepared to project the company's corporate activities.

7. Liaise with other departments to arrange material and manage printing of the Annual Report.

8. Manage development and printing of promotional and information material e.g. posters, leaflets etc.

9. Arrange outreach activities including seminars, events, radio talk shows and press briefings on corporate and power related issues.

The PR Process and Practices: The Public Relations Office at IESCO undertakes the external communication at local media level only. Main media products are press releases, load shedding schedule, shut downs or procurement (tender) notices. Main outreach activities include occasional seminars on energy efficiency & conservation, press talk show, radio show and collaborative events management.

The press scanning material is compiled and submitted to CEO on daily basis. This review is shared with other concerned departments for their information and input. The PR department liaises with local media for corporate coverage, clarification and handles the press at local level.

Though the PR Office undertakes a variety of above mentioned functions, it does not have any separate budget for its activities.

Review of Existing and Previous Communications and Media Mix

The local press is the most common media channel used by the PR department followed by dissemination through radio. The role of the PR department is restricted only to the local media as PEPCO enjoys the authority to conduct national media campaigns on behalf of all the DISCOs, including IESCO.

Except the issuance of press releases and a small number of advertisements, there is no significant media campaign that has been launched or managed by the PRO. Moreover, the PRO does not have any calendar of media events and activities. The issuance of press releases is undertaken on a need basis. A very limited number of outreach activities were executed, mainly concerned with energy conservation and safety seminars. The press releases were issued to ensure coverage of IESCO's activities, power shut down situation clarifications, safety plans and practices. Other than press coverage, information products such as posters and leaflets on issues relating to safety and energy conservation were disseminated.

External and Corporate Communications and Outreach Practices

The external communication of utilities, like internal communication, is equally important for developing an effective interface with the stakeholders, particularly consumers and other market players. With the increasing electricity demand-supply gap, it becomes much more critical for IESCO to provide reliable and timely information to the consumer. As a priority, promoting its role to the greater public contributes to building consumer perception and trust in the utility's ability to serve a large territory of electricity consumers. There were few outreach activities reported limited to energy conservation seminars.

The lack of availability of budget and capacity of related personnel was seen as one of the constraints in consumer outreach. Since PEPCO carries out the national media outreach for consumers, it claims the maximum share of the publicity budget of IESCO, limiting its ability to reach out to the consumers, which further erodes its corporate image.

Except the schedule of few of the open hearing (*Khullee Kutchehreys*), no calendar of activities is prepared. Most of the activities carried out were need based rather than planned corporate activities. Outreach activities included series of seminars and a walk on energy conservation. Posters and leaflets on energy conservation, safety and security, and theft control have been found on the walls at IESCO headquarter and in the customer service centre in Blue Area

Customer Complaint Centers

IESCO operates ten Customer Services Centers at a number of locations within its area of service. These include one Chief Executive's Complaints & Monitoring Cell situated at IESCO Headquarters in Islamabad. The remaining Centers are dispersed across the utility's service territory. They are authorized to issue duplicate bills and entertain complaints related to faulty billing, restoration of power supply, reconnection, and issuance of new connection forms. They also provide the facilities of bill payment by installments of upto Rs. 20,000 and payment due date extension for upto 3 days.

In addition, IESCO has launched a Mobile Van Customer Service Centre, offering all the above mentioned as well as actual bill payment facility. IESCO has the UAN (111-390-390) and a toll free number (0800 25250). Along with these telephone numbers, the company also operates the 118 helpline. Utility bills contain the URL of IESCO's website (www.iesco.com.pk), plus the mobile numbers of concerned sub-divisional officers & executive engineers. The bill also contains a toll free number (0800-84338) to report theft of electricity.

Current State of IT for External and Internal Communication

The computer and information technology penetration at IESCO is dismally low, whereby only 600 computer terminals are available for more than 13000 employees. Almost all these terminals are connected through broadband internet. However, a very little number of top officials including the CEO operate official email accounts. IESCO's website appears to be a good effort to provide information to the stakeholders. Each of the departments (operations, finance, engineering, development/planning, etc) has been given administrative password to keep their respective pages updated. Nevertheless, potential of web portal can further be explored to make it an interactive and dynamic platform for internal and external communication.

Customer Services and Complaint Handling with a Gender Perspective

Other than the appointment of a few ladies at the CE Complaints & Monitoring Cell at IESCO Headquarters, the concept of gender equality has not been promoted in the organization, let alone at its Customer Service Centers.

3. RECOMMENDATIONS

a. Governance

The Board of Directors has not functioned effectively as a corporate board. The CEO has been appointed by PEPCO, on behalf of MWP, and not recruited by the Board. He is also a member of the BOD's Audit Committee which constitutes a conflict of interest.

The newly reconstituted BOD will need both governance and electric utility training. The newly defined Board of Directors will require training to prepare them for the challenges of governing IESCO in the changing utility environment of Pakistan, and of advising board members of their roles and responsibilities vis-à-vis the MWP, NEPRA, and other stakeholders in the power sector.

IESCO is in the process of fulfilling all requirements necessary for becoming a listed company. Accordingly, the Companies Ordinance of 1984 as amended, section 204(A) requires it to have a full time Company Secretary. Currently, this role is being fulfilled by the Director Finance.

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

b. Engineering & Operations

The engineering results section (section 2.2) presented the process and results of a mapping and modeling exercise for a small sample of IESCO feeders. This section presents conclusions resulting from observations and analyses, as well as recommendations of opportunities for improvement.

Planning Processes

IESCO's planning management clearly understands the need for integrated distribution planning as a means of arriving at an optimum distribution network design. The two prerequisites for integrated planning are accurate geographical maps, and analysis software that is easy to use and can incorporate geographic input.

An effective mapping method would be the use of GPS units to locate facilities in the field followed by transfer of the information to a geographic information system (GIS). This would make the information available for direct transfer to more sophisticated analysis software that can directly accept digital input. Advanced analysis would require the purchase of a new analysis software package, but this cost is small in relation to what has already been expended on the existing system. IESCO could therefore have a fully up to date mapping and analysis system at low cost.

IESCO has also already developed staff resources capable of using a new system. Although they have not received training on GIS, they are competent professionals with the ability to adapt to a GIS environment, and to make use of advanced analysis tools.

Standards and Specifications

The updating of standards and specifications is handled by NTDC's Design and Standards Section. WAPDA construction standards have generally served IESCO 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 Islamabad, transformer losses account for a significant portion 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. IESCO 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 IESCO fails to take advantage of the principal opportunity for reducing the costs of materials, and that is the economies of scale. The utility procures a large amount of goods annually, which should give considerable leverage in obtaining favorable pricing. However the procurement process breaks this relatively large quantity of procurement into over 100 separate solicitations, largely diluting the benefits that could be obtained. The company is still using the archaic category system outlined above, necessary to ensure that all vendors received some portion of the orders when WAPDA was a government agency, but less appropriate now that IESCO is corporatized. 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 preferred 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 IESCO's needs for materials could be satisfied by 8-10 procurements a year; two each for poles, hardware & accessories, cable & conductors, and transformers. Special purpose solicitations may be necessary for turnkey items such as substations, but even these should be few and large. It may even be possible for sharing of procurements between DISCOS, allowing for increasing the size of procurements to levels definitely attractive to international vendors.

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

Construction Quality

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

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

The PDIP Engineering team noted the poor condition of the underground LT network and the immediate need for repairs, both to improve meter security and to reduce hazards to the public.

Operations

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

The PDIP's engineering team found that at the subdivisions, procedures do exist for almost all tasks, but that the staff was reluctant to comply, particularly with such record keeping tasks as measurement of transformer loading and rebalancing. Their lack of effort in this regard is reflected in the generally high level of transformer failures.

The team did find the subdivisions both overstaffed and under equipped for their assigned tasks. It was commonly stated that roughly half the linemen are not able to climb, while lack of equipment reduces the ability of ground bound assistant linemen to be of any assistance. Thus even large crews are limited to watching a single lineman on a pole or in a tree and are not productive. Tools, both hand tools and heavier equipment, are in poor condition, and 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 handled by the linemen traveling on their own motorbikes.

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

Meter Security
The PDIP team found that the security of the meter itself has improved in recent years with the advent of electronic meters that cannot be opened by normal means even when the seals are removed. Innovative power thieves have succeeded in violating these meters, but there is no question they are more resistant to tampering than the older electromechanical meters. However the primary threat to meter security is not the meter itself, but 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. IESCO has taken steps towards providing improved security for exposed connections by installing security slips.

Another concern is the existing fleet of electromechanical meters, numbering in the millions that are still in service on the system. These meters were in most cases not highly accurate to begin with and age has not improved their performance. These meters have not been tested since installation, and while it is certainly in the utility's long term interest to replace them, to the extent that they can be assured of a reasonable level of accuracy through inspection and testing, 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 IESCO 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 IESCO were found to be 13.7%, broken down as follows:

- Conductor Loss 5.2%
- Transformer Loss 2.8%
- LT Network Loss 5.6%
- Service drop loss 0.1%

This estimate for total technical loss of 13.7% was not in conformity with either IESCO reported losses, or to a benchmarking technique independent of any system modeling, and so is may not be a valid estimate for overall distribution system technical loss.

Opportunities in Loss Reduction
The opportunities for loss reduction in IESCO are mainly technical, although it seems the utility is overemphasizing reduction of non-technical loss thereby compensating technical loss. However in order to have a reliable, efficient and more secured distribution network, opportunities do exist in IESCO.

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. As noted,* 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. Its use 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 advanced planning software.* Advanced planning software that accepts digital input from GIS databases and has a graphical output can speed consideration of alternative system

designs and assist in developing integrated distribution plans. Use of such software will allow for consideration of potential problems before they result in high losses or poor service quality.

HT Improvements

IESCO's average feeder length is almost 73km, 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.
- *Selective reconductoring.* The majority of 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. These reflect 20% of IESCO's technical loss, and technologies exist to cut even the current new specification losses substantially.
- *Review of long feeders (over 60km in total length) o*n the basis of voltage drop rather than thermal capacity. The current method of identifying problems only when conductor loading exceeds 300 amps is inappropriate for long rural lines. These circuits have already entered into voltage problems and high losses long before reaching the 300amp threshold.
- *Application of compression connectors for most taps and other joints.* So as to eliminate jumper burnouts. Points at which sectionalizing is done would be retrofitted with bolt-on connectors to facilitate disconnection. Replacement of wrapped joints would reduce callouts for jumper failures and improve service quality, though the impact on losses would be small.

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.
- *Replacement of open LT distribution boxes.* LT distribution boxes in the underground system at Islamabad Capital area should be properly maintained by replacing the damaged distribution boxes, and rectifying other equipment and accessory defects such as missing covers, substandard cables, damaged LT bus bars, compression lugs, and inappropriate concrete plinths etc. Improved distribution boxes should be combined with cluster type meter enclosures to enhance meter security in the underground system.
- *Relocation of transformers.* So that they feed the center of an LT sector rather than the end. This would reduce losses on the affected LT sector by 50%. The incidence of end-feeding is uncertain.
- *Retrofitting of compression connectors for jumpers and other high current joints, and improvement of the connections to the LV bushings of transformers.* The present system of wrapped joints produces a significant level of callouts for overheated joints which, though not a loss issue does affect consumer service quality.

Metering Improvements

- *Introduce an electromechanical meter testing program.* That is oriented toward ensuring accuracy of electromechanical meters until they can be replaced with electronic units. This would be combined with an accelerated program for changing electromechanical to electronic meters.
- *Evaluate options for improving the security of meter installations.* By using connection boxes and neutral concentric cable as opposed to unguarded open installations. The customer cannot be given access to meter bottom connections or the installation has no security at all. Neutral concentric cable encloses the cable in a grounded sheath so that any attempt to penetrate the cable with a sharp item such as a nail or an awl will cause a short circuit and defeat the attempt.
- *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 need 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.

c. Financial Management

IESCO collections are reportedly at 98.4% of commercialized and 83.2% of government energy sales. A particular problem with government collections are sales to AJK, which even if not in arrears would be loss making. The tariff for such sales is less than the cost of wholesale power, and since sales to AJK represent 10% of total IESCO sales, continuation of this arrangement is of serious concern to the company's financial wellbeing. In addition, there is a significant receivable as AJK is disputing the tariff and refusing to pay the bill. IESCO should actively lobby to move responsibility for sales to AJK directly to CPPA, acting only as a transport agent for the power. Deliveries of both demand and energy to AJK would be deducted from power purchased by the utility, plus losses on its transmission network.

As reported in the results chapter of this report, IESCO has a reasonably effective arrangement with the banking system and other local payment to collect funds from its consumers. This ensures that collections are managed effectively and relatively efficiently. However, there are two issues with the system. First, many collection points – including some banks – retain customer payments to the company for much longer than they should. The pay points should transfer funds on a daily basis, but many retain the receipts for up to a week. Approximately 85% of cash receipts are received on the same day they are paid to pay-points at the utility's principal bank account. The remaining 15% are receipts from post offices which may take a week. Remittance of these funds from IESCO to the CPPA in payment of purchased power is important, and creates a significant loss from the perspective of the latter.

A practical area in which IESCO is progressing concerns the ERP framework now approved for implementation by BOD/NEPRA. It will provide the means to integrate business, human resources, engineering, asset management, work plan management, and operations into an electronic environment that can be used real time in all phases of IESCO operations. Enterprise systems offer the opportunity to convert manual business and distribution operating systems to electronic, computerized management

systems. The ERP software system interface will allow other applications to be integrated and permit full system interface with all these. All this will be important as IESCO transitions into customer information and billing systems, GIS and other applications

Enterprise systems allow electric utilities to employ financial and management controls that would otherwise be absent. Its full implementation will also allow an internal control audit to identify vulnerabilities in accounting and workflow management, and address these through improved controls & management processes.

The Manual being produced by the Finance Dept's system implementation team should be a valuable resource for system design, training and internal audit, essential for safeguarding the company's assets. The team considers this a best practice which should be part of any implementation process.

The regional warehouse facilities observed were built in the 1960s when the area was largely rural. However, the extreme growth and development of urban sprawl has made these existing facilities inadequate to meet the needs of an operationally efficient and secure store. IESCO needs to expand and upgrade its regional warehouse/stores facilities in consonance with the Capital territory's widespread urbanization since these were established in the 1960's.

IESCO needs to revise/expand/enhance internal audit practice & procedures, the circa. 1985 WAPDA Audit Manual being inadequate to effectively audit the company's finances & functions, particularly in an ERP environment.

It is interesting to note that, the internal audit division has only partially complied with the scope defined in the existing audit manual, that states, "Internal Audit Division has to insure that rules and orders framed/adopted by the Authority from time to time in connection with execution of works, pay and allowances, stores, etc. and for maintenance of various accounts, books, etc. are followed by all WAPDA formations/offices and the defects and irregularities noticed in such accounts/ books are rectified as far as possible.." At present, the Internal Audit Department performs merely limited reviews of certain transaction-based activities rather than focusing on full reviews of internal control systems.

The IESCO Accounting Manual has likewise not been revised since 1985; there is an immediate need to revise/update/improve this document also, especially to comply with NEPRA requirements once the latter defines the chart of accounts.

There were a number of instances of government involvement noted which inhibited IESCO operations. These include:

- PEPCO has currently placed a ban on the purchase of new vehicles when one third of the vehicle fleet is 20 years old.
- PEPCO is the de facto authority for approving ERP implementation and certain recruitments and new positions.
- In 2008 four DISCOs including IESCO were asked to obtain loans to subsidize government shortfall in power costs incurred by all DISCOs.
- All DISCO investment projects are required to be filed with the Planning Commission (PC), CDWP and ECNEC for approval regardless of funding status; a laborious and time-consuming

process. IESCO has significant financial vulnerability due to lack of insurance coverage on its facilities, only grid stations and certain new vehicles being covered.

Financial & Accounting Recommendations

1. IESCO should hire a Consultant to revise and update its Accounting and Internal Audit Manuals in line with the movement to modernize the utility, to increase internal auditing scope to effectively assist the BOD, and adjust to the new ERP environment.

2. Evaluate means of improving transfers from certain post office pay-points to IESCO bank accounts.

3. Initiate implementation of the ERP platform, and expand applications to serve all finance and accounting needs in line with control, management, and financial reporting requirements to the BOD, NEPRA, and MWP as needed. This would include developing an in-house IT support structure to accommodate the service needs of the organization.

4. The Rawalpindi main warehouse facility needs a new site location to meet current corporate demands for operational efficiency and cater to the Capital territory's widespread urbanization.

5. IESCO should purchase a ten year financial forecast model for its business planning purposes, and arrange appropriate training thereon.

6. It should 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 IESCO suffers from association with the Pakistan power sector and has only limited access to long term capital. Because of its wholly owned government status, banks are reluctant to lend significant amounts unless ordered to do so by the government. A classic example is the order by the MWP in 2008 for IESCO and a number of other solvent DISCOS to obtain loans to support the government's own shortfalls in financing power costs for other, less solvent DISCOS. In the face of such risks, it is no wonder that IESCO's only source of large scale financing capital is the government. Often the proceeds of loans by the World Bank or ADB, such government financing as noted is not reliable or predictable, nor is its availability dependent on the financial strength of the DISCO itself, thus reducing the requirement for internal fiscal discipline. The shortage of reliable, reasonably priced investment capital has a significant impact throughout the organization, reducing the emphasis on long range planning, in favor of make-do arrangements. Such a dependence on government financing must end if the utility is to be able to reliably carry out its obligations to its consumers and function as a true corporate entity.

d. Commercial Management

The following are key recommendations for commercial management:

- There is an urgent need to introduce automation technology into commercial management of IESCO. Use of AMR; prepayment metering technology; handheld meter reading technology, and other current communication and metering technologies would eliminate reading and transcription errors and reduce vulnerability to employee and consumer manipulation of metering data. Use of AMR meters on industrial clients and transformers would make energy accounting more readily available, and would support work planning and analysis of the distribution infrastructure. An essential part of any such technology implementation is

proactively involving employees who will be directly impacted by the changes to design new and better business processes.

- Management should enforce provisions of the Commercial Procedures that require verification of a prescribed number of meter readings and bills delivered, ensuring that "losses are brought down to a bare minimum and bills delivered to the consumers." This will discourage customer meter fraud and deter collusion between customers and employees.

- Similarly, transactional audits should be performed to confirm that billing system adjustments are legitimate and conform to company standards.

Billing cycle and energy accounting

- Improving billing cycle efficiency will result in accelerated revenue collections, allowing IESCO to generate short-term interest for dividends, or to allow CPPA to reduce interest and penalty charges that may accrue from delays in payment to GENCOS.

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

- 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 commercial losses. Energy accounting could be accomplished by a number of methods. Use of AMR meters as revenue meters, or at delivery points, would allow IESCO to accurately monitor consumption via electronic, real-time means. Energy accounting could also be accomplished by using conventional electronic meters on distribution transformers, although this would be subject to the integrity of the meter reading process. However, if subdivision management were to focus on areas where losses are highest, making a concerted effort to audit meter readings at delivery points, this would support an effective loss reduction program. An effective energy accounting initiative would not only result in lower administrative losses, it would also result in higher billings leading to more income to the DISCO.

Improved consumer service

- IESCO should establish a Call Center that tracks consumer complaints, forwarding calls to the appropriate party. This would provide a central location for consumers with immediate connection to someone who can resolve their issues. The center should also be required to follow up with the consumer to determine that the complaint has been resolved (not just addressed.)

- The company should consider assigning personnel to complaint resolution on a dedicated basis, with proper training, and accord them reasonable authority for resolving issues to eliminate the need for consumers making repeated visits to the service center.

Summary of 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 by switching from electromechanical to electronic meters will have little effect, for example, unless organizational and procedural changes are made in the meter reading auditing process to detect fraud or manipulation of the data. Implementation of a CIS will require new accounting, data collection & transfer, and billing procedures. Best practices require that a consumer census be taken to populate the CIS database with accurate information.

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

- Consumer Census to verify/add consumer and additional information to be used in the CIS.
- Installation of a new CIS.
- Reorganization of corporate structure so that all commercial units report to the Director Consumer Services.
- Update metering, using advanced metering technology where appropriate, and evaluate use of meters on selected distribution transformers.
- Reorganize meter routes.
- Implement energy accounting.
- Design more comprehensive customer service and consumer awareness programs.
- Enforce meter reading audits and meter inspection programs.
- Institute systematic meter repair, testing, and calibration.

e. Human Resources

As described earlier, IESCO's HR policies & procedures have remained static for the past quarter century, and inhibit the company's required recruitment of able and dedicated personnel. While revising these protocols is a major task, this will require a modest investment of time. The changes, if accepted and implemented, will require a substantial buy-in from company management and staff. Some of the changes will be back-office in scope, such as redefining job descriptions, a comprehensive compensation study, and hiring and advancement of policies. Others will require a high degree of retraining, communication with management and staff, as well as several fundamental changes needed to develop a corporate culture.

The principal changes necessary concern the compensation package, the hiring and promotion program, and the performance management program. As mentioned earlier, the fundamental changes will need to occur in redefining position descriptions, position requirements, lines of authority, and other related factors. Concurrently with upward adjustments in salary structure, there will likely be a need to sustain significant staff reductions through outsourcing and attrition to bring IESCO at par with the best practices. The company culture itself will need to change reflecting a balanced equation between responsible management and dedicated employees.

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

Recommendations

The PDIP team recommends that the following changes and initiatives be undertaken at the earliest:

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

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

3. Revise the compensation & benefits system/package, making it attractive and competitive; a detailed, broad-based market study will be required to devise this, and to select an effective methodology for its introduction into the DISCO; e.g. The new package being offered as an incentive to those employees opting for the new, performance-based terms and conditions etc.

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

5. Introduce more advanced information technology for use in HR management (HRIS), as well as enhanced level of IT in the training facilities.

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

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

8. Establish a robust lineman safety program providing structure, incentives, and discipline for all linemen employees. Ensure that they are provided with and required to use proper clothing and safety gear while performing construction & maintenance tasks. It will be the DISCO's social responsibility to extend the safety message to the public/customers, through an effective communication & outreach program.

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

10. Based on the far flung rural networks being serviced by IESCO, it is proposed that a Regional Quota System be developed for different circles whereby local induction from the relevant district takes place; e.g. given a vacancy for 200 employees, 100 should be recruited from the specific area. This will provide a continuous, practical and onsite human resources base to service IESCO's outer regions, as well as generating income for the local population.

f. Communications and Outreach

The assessment of IESCO's communication and outreach strategy has resulted in the following recommendations:

1. Reorient the utility's decision makers towards utilizing information and communication technology and related tools as instruments for theft control, reduced electricity losses, and enhancing receivables. This re-prioritization should in turn promote technology usage by its personnel, and consequently facilitate the company's effective internal and external communication strategy.
2. Gradually increase the currency of computer, internet, email and IT usage in internal and external communication, linking mandatory training thereon to increments and promotions.
3. Promote the development of an Intranet. Once data base is developed and mechanism of regular updating is in place, level of access of information to different managerial levels may be decided as per job requirements.
4. Utilize the interactive web portal as a platform for external communication by managerial staff, who should also have official email addresses and assured networking.
5. Strengthen the capacity of the PR Department through allocation of dedicated budget to enable it to plan and execute a communications and outreach strategy, mass media campaigns and outreach activities at local and national level. An Annual Calendar of these engagements should be developed, and issues of Corporate Social Responsibility (CSR) & brand equity should be regularly promoted. Its reliance on PEPCO must be reduced to enable all of the above.
6. These should contain maximum information regarding the utility's billing, meter reading, policies and plans.
7. Actively engage groups of consumers through outreach activities to promote dialogue on company related issues of tariff, safety, energy conservation, system upgrading, constraints, investments etc. Seminars, public dialogue, press shows, radio talk shows, collaborative events are some examples to be carried out on regularly planned bases.
8. Depute dedicated and trained staff at various service centers to depart from the current practice of depending on field duty staff. All Customer Service Centers should be equipped with modern information communications tools and connected with the central database.
9. Develop a speedy and efficient complaint resolution mechanism, advertised through all available media outlets. The website should include a complaint facility and arrangements for online redressal. Call centers may be introduced for prompt response to consumers' complaints and queries.
10. Ensure gender sensitivity at the Customer Service Centers by providing (wherever possible) separate windows, seating arrangements, and public utility services for incoming women to lodge their complaints. Female staff should be recruited in the dedicated CS workforce up to circle level.

APPENDIX: AUDIT METHODOLOGY

A.1 Overview of Data Collection and Process Assessment

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

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

1. DISCO governance
2. Organizational review
3. Engineering assessment
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 will allow the PDIP team to identify high impact performance interventions.

A.2 Governance

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

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

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

2. Board policy and procedures manual, if available.

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

4. Board Member appointment process, terms & 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, and provisions for extraordinary Board meetings.
8. Board Member fee structure – are Members reasonably compensated for their participation?

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

A.3 Organizational Assessment

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

1. Analysis of organizational design & structure.
2. Review of DISCO departments and divisions.
3. Review of key managerial positions and job 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.

i. A.4.1 Transmission Review

The transmission review consists mainly of an evaluation of the contribution of transmission losses to overall system losses. In the event that transmission losses do not constitute a significant component of overall system loss, the evaluation will be truncated. In most cases the transmission networks of the DISCOS are quite robust and are not a source of problems, and therefore it is expected this segment of the evaluation will be very limited.

ii. A.4.2 Distribution System Management

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

Typical questions explored by the engineering team will include:

- Status and currency of system maps.
- Processes used for distribution system planning.
- Methods for procurement; adequacy and availability of materials.
- Adherence to standards in construction and a visual review of quality of construction.
- Meter security and vulnerability to tampering.
- Operations practices and adherence to established policies and procedures.
- Adequacy of lineman safety programs and equipment.

iii. A.4.3 Segregation of System Losses

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

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

1. Power delivered to each feeder by month for FY 2010 (July-June).
2. Commercial sales data by feeder, as available for each month of FY 2010.
3. Length of 11 kV feeders and laterals – by substation, as available.
4. Engineering standards including standard conductor size for all voltage levels, 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 will then select a group of feeders from the record provided that, as a whole, it represents the principle characteristics of the DISCO; that is, sales distribution between domestic, commercial and industrial consumers, as well as average feeder length.

Each DISCO has up to, and in some cases over, 1,000 11kV feeders, so it is necessary to establish sampling criteria as follows:

- Feeders will be selected by a random number process so that each feeder has as much chance of being selected as any other. This will enhance the potential that the set of feeders will be truly representative of the system as a whole.
- Average feeder length of sample population should be close to the average feeder length of the overall feeder population.

- Distribution of sales in kWh/year between domestic, commercial, industrial, agricultural and other consumers for the population of sample feeders should be close to that of the overall DISCO feeder population.
- The sample feeders should have complete data, including total sales and feeder input data, and total length. Feeders with data anomalies would be excluded.
- Total feeder length will be limited to 200km, which is the length of line that the PDIP GIS team can survey in the time period allocated.

Once the 11kV feeders have been chosen, a total of no more than six LT networks will be chosen for detailed analysis. Because data is limited for LT networks, it will be necessary only to specify that the LT networks chosen be fed by the selected feeders. To the extent possible they should be chosen randomly from the set of general service distribution transformers on the selected feeders.

11kV Feeder Mapping and Analysis

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

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

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

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

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

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

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

LT Network Mapping and Analysis

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

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

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

Where:

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

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

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

Service Drop Losses

Service drop losses can be calculated on the basis of the assumption that all domestic sales used mostly single phase meters, while all commercial and direct reading industrial sales used three phase meters. In

most DISCOS, an effort was made at some point in the past to move meters to the base of the pole as opposed to being mounted on the exterior of the residence. This had the effect of shortening the effective length of the service drop from the utility's standpoint, to something less than 10 meters. Examination of the system indicates that this process has not been completed in many urban areas, and the meters are still located on the exterior of the buildings. For this reason, the average service drop length has been assumed to be 12 meters. The table below indicates the assumptions for the three types of consumer.

TABLE 2.6 CHARACTERISTICS OF SERVICE CONDUCTOR

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

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

Calculation of Energy Losses

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

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

Where:

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

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

Once the components of energy loss for the sample are determined, consisting of conductor loss, transformer loss, LT network conductor loss, and service drop loss, it is possible to sum all the components to determine the technical losses for the sample and thus for the system as a whole. Any

difference between the stated distribution losses of the DISCO and the technical losses calculated by this method would constitute an estimate of non-technical loss.

Validation of Results

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

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

Where:

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

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

Applying this equation to IESCO results in the characteristics shown in Table 2.8:

Table 2.8 Results of load versus loss analysis.

IESCO BENCHMARKED LOSSES			
HT & LT Km	**Sales Density MWh/Km**	**Benchmark Technical Loss %**	**Actual Distribution Loss %**
49,983	151.5	6.9%	7.8%

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

iv. A4.4 Distribution Standards

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

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

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

The first operational audit undertaken at LESCO will serve as a vetting process for the above described plan. The financial audit team will work as a single unit at LESCO to ensure that all team members gain the experience and understanding of the assessment process, and to adjust the audit process for later DISCO audit processes.

Once the IESCO audit begins, the finance team will meet with the IESCO 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 will meet 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 will review IESCO's organizational policies and procedures, annual report, system of accounts, interviews with DISCO management and employee personnel. Templates have been developed as a data gathering tool to populate various financial models which will be used for analysis. The financial management team may need to coordinate with the commercial management team to ensure that information and data that may be needed by both teams is shared and incorporated into the analysis and reporting process.

Analyses

Analyses will include an evaluation of financial management processes, management of banking functions, management of cash and receivables, internal control processes, and overall management of DISCO financial performance. Results of these analyses will be presented in the form of data tables, performance ratios, and discussions of specific issues that do 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 will be on the revenue cycle which includes the registration of new consumers, meter reading practices, bill production & delivery, and receipt of consumer payment information. Other activities such as the disconnection and reconnection process, bill adjustment procedures, and customer services will also be reviewed. These examinations will be made so as to identify opportunities to increase the efficiency and transparency of commercial activities, and improve the financial performance of the DISCOs. Opportunities to improve financial performance may include revisions to current procedures with technological enhancements, or replacement of the billing system with a CIS to better manage customer information through records of all customer interactions in addition to preparing bills. The commercial assessment team shall consist of international and Pakistani consultants, led by a Commercial Specialist, who have practical work experience with one or more electrical distribution companies, plus understanding of utility commercial practices and procedures.

Data Collection

Procedural data will be collected through interviews and observations. The overall commercial process will be ascertained from the Commercial Director. He will be given the opportunity to discuss specific problem areas and activities deemed crucial to the revenue process. Procedural details for each activity and the time required will be obtained from the in-charge department heads. These procedures will be verified by observing the actual practices at selected Revenue and District Offices and pay points.
The commercial team will also collect billing/collection/consumer data from the billing system. Not only will this data serve as a baseline reference to gauge future results, but may also be used to provide an indication of the time to complete the revenue cycle. Other hard data to be collected during the interviews includes the number of meter reading routes, actual number of meters in a route, frequency of meter tests and calibration, customer billing complaints, and number of employees involved in the revenue cycle.

Strategic Analysis

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

The interventions will likely include a combination of investments in secondary distribution systems, transformers, services, and revenue meters; as well as changes in commercial system practices and procedures to improve DISCO metering and revenue recovery practices. The procedural changes may

require the addition of devices that will eliminate transcription errors, speed the data entry, or increase internal controls. The Commercial Specialist shall also evaluate and make recommendations regarding the effectiveness and adequacy of commercial software (the CIS), with the aim of determining if a software solution that more effectively integrates commercial, accounting, human resource, work order, and other DISCO functions would be merited.

A.7 Human Resource Management Audit

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

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

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

Data gathering shall include:

1. Internal interviews and surveys given to department managers and senior engineers.
2. Interviews with Chief Executives and senior management to evaluate the company's vision, mission and strategic objectives.
3. Identification of major functional skills and competencies.

4. Surveys of staff from engineering, commercial management, system operations, and DISCO administration at the Division and Subdivision levels to include roles and responsibilities, adherence to existing DISCO procedures including health and safety, and any other standard operating procedures that exist within the DISCOs.

Review of HR strategic and functional analysis includes:

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

Evaluation of training and capacity building needs will:

1. Develop a training needs assessment survey form.
2. Conduct training needs survey by distributing needs assessment forms to department heads to determine critical skills & competencies gaps. This shall be translated into the launch of an urgent training program in the pilot project phase.
3. Identify essential and immediate training needs for engineering, financial management, commercial management, and human resource functions at the DISCOs.

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 as well as processes and tools employed to communicate, to a large extent determine its corporate priorities for internal and external stakeholders. One of the major differentiating features of progressive vis-a-vis status-quo driven organizations is the practice of contemporary modes of communication, openness, and scientific knowledge management enabling efficient and speedy decision-making and thus the greater good of the organization.

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

The Communications Assessment includes:

1. Review and analysis of existing internal/external communication & outreach strategy, organizational chart of relevant departments, and job descriptions of relevant staff.
2. Review of existing/previous communication & outreach campaigns, materials, media mix, budgets, and communication briefs etc.
3. Visits to Customer/Complaint Centers to obtain first hand information regarding onsite communication with customers in terms of customer services, complaint handling style, clarity, processing time, and delivery practices. The customer services and complaint handling were also reviewed with a gender perspective.

4. Review of internal communication process and feedback and follow up status, to assess the efficiency of internal communication.
5. Review of current state of IT being used for external/internal communication.
6. Identification of training needs for relevant staff.
7. Assessment of current practice of various communication tools/vehicles e.g. website, newsletters, emails, event management, and other multi layered activities.

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

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

Internal Communication

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

External Communication and Outreach

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

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

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

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

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

Focus group discussion:

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

Review of documentation:

Review and appraisal of relevant material available with the PR, MIS and CS Departments was undertaken, covering records of daily press cuttings, press releases, printing & publications; practices & processes of data collection, bills printing, output reports; and registers recording details customer complaints, to appreciate the efficiency or otherwise of the current system.

Visit to the customer center:

The Customer Services Centre located at the DISCO head office was visited to understand the complaint handling process, as well as to gauge the level and quality of customer service delivered.

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