INTERNSHIP REPORT

ON

TECHNICAL TRAINING AT DESCO

By

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Mir Hasan Ali (2006-2-80-033)
Md. Iktadir Bhuyan (2006-2-80-034)

Submitted to the

Department of Electrical and Electronic Engineering
Faculty of Sciences and Engineering
East West University
In partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering
(B.Sc in EEE)

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POWER IS YOURS

LECTRIC SUPPLY COMPANY LTD

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August 01, 2011
Memo No: DESCO/Trg. & Dev/2011/ 306

To Whom It May Concern

This is to state that Mr. Rifat Ahmed (Student ID: 2006-2-80-012) student of Electrical and Electronic Engineering program (B.SC) in East West University Bangladesh, has successfully completed Twenty (20) days Industrial Training from 02/05/2011 to 30/05/2011 in DESCO and complied all the requisites of Training & Development, HRM Division, DESCO.

I wish him all the success in his career.

Engr. Akharul Islam
Manager (Training & Development)
HRM Division.

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August 01, 2011
Memo No: DESCO/Trg. & Dev/2011/ 302

To Whom It May Concern

This is to state that Mr. Md. Iktadir Bhuyan (Student ID: 2006-2-80-034) student of Electrical and Electronic Engineering program (B.SC) in East West University Bangladesh, has successfully completed Twenty (20) days Industrial Training from 02/05/2011 to 30/05/2011 in DESCO and complied all the requisites of Training & Development, HRM Division, DESCO.

I wish him all the success in his career.

Engr. Akharul Islam
Manager (Training & Development)
HRM Division.

Acknowledgment

First of all we would like to thank S.M. Zamil Hussain, Manager (Training & Development) DESCO for allowing us to do the internship and work in DESCO

We would also like to thank our advisor Dr. Khairul Alam, Assistant Professor, Sharmin Rowshan Ara, Senior Lecturer and S.M. Shahriar Rashid, Research Lecturer, Department of Electrical & Electronic Engineering, East West University, Bangladesh.

We would also like to mention the name of Dr. Anisul Haque, Chairperson & Professor of the Department of Electrical & Electronic Engineering and Dr, Kazi Mujibur Rahman, Adjunct Faculty Member, Department of Electrical & Electronic Engineering, East West University, Bangladesh for being so kind during the period of our internship. We are also grateful to all of our teachers and friends for their cooperation and encouragement throughout our whole academic life in East West University. We also would like to thank some persons who dad given us appointment from their precious time to collect related data of our report and also helped us to understand many related matters and gave us their precious time to us more than once, they are Engr. Tanvir Ahmed, Asst. Manager (Kafrul S&D Division),Engr. Shawkat Ali, Asst. Manager (Kafrul S&D Division), Engr. Zulfiquar Tahmid, Manager (DESCO HQ Banani), Engr. Habibul Hasan Chowdhury, Asst. Manager, IT, Md. Abdul Mannan, Jr. Asst. Manager, Control Room Mirpur 12, Engr. Md. Golam Mowla, AM (Grid & Protection), DESCO.

At last but not at the least we would like to thank the almighty Allah for giving us the chance to complete our internship and preparing the internship report.

Executive Summary

Electricity is the main key for development of a country. Proper supply of electricity has a positive impact on GDP of a country. In Bangladesh, we have a shortage of electricity production. Still only 60% of our entire populations are getting electricity. People, who are getting electric lines, are also facing a huge number of load shedding. After the liberation war, every government tried to improve power sectors but still Bangladesh is struggling. The most pressing problem in the power sector has been with the distribution system, which is characterized by heavy system loss and poor collection performance. Dhaka Electric Supply Company Ltd. (DESCO) was created in 1996 under company Act 1994 as a public Limited company to improve better revenue collection and better consumer service.

DESCO purchases electricity from Bangladesh Power Development Board (BPDB). Then, electricity is transmitted from the Power plants to DESCO's receiving sub-stations through the National Grid. Power Grid Company Bangladesh Limited (PGCB) is in-charge of the National Grid any they receive charge for transmission of electricity through the National Grid. Then, DESCO distributes electricity to the consumers through its own distribution network and collects revenue against the electricity usage.

We have done our internship with DESCO, which is a distribution company. We have seen a lot of operations of DESCO having a vast experience about how the distribution networks are maintained, Customer service, Administration, IT department, Grid and Substation maintenance, Control room operations etc. We have tried to cover all the operations of DESCO during our 100 hours internship.

Internship Schedule

Date & Time	Location	Topics	Coordinator / Facilitator	Remarks	Working Time	Hours
2/5/11	Training & Development Division, DESCO HQ Banani	Welcome Speech & Introduction to DESCO	S.M Zamil Haque Manager Training & Development	On Desk	9am to 4 pm	6
3/5/11	Administration , Division, DESCO HQ Banani	Administrative activities of DESCO	Md. Taufique Abdullah Manager Administration Md. Alamgir Manager, Finance	On Desk	9 am to 5pm	7
4/5/11	Pallabi S&D Division, DESCO	Commercial Operation , Disconnection & One Point Service Center, System Server Operation	Engr. Md. Raihan Arefin DM (C/O) Ms. SHabnam Mina Jr. Asst. Mang.	On Desk & Practical	9 am to 5 pm	7
5/5//11	Pallabi S&D Division, DESCO	Reconnection, Metering, Billing, Collection, New Connection & IT Section	Ms. Shabnam Mina Jr, Asst. Mang. Shahenewaz Begum Jr. Asst Mang Engr Habibul Hasan Chowdhury, Asst. Mang. IT	On Desk & Practical	9 am to 5 pm	7

8/5/11	Kafrul S&D Division	Substation Operation , S&D System Operation, Load Sanction & Load Retention	Engr. Mirza Abu Naser Dep. Manager & Engr. Tanvir Ahmed Asst. Manager	Theoretical & Practical	9 am to 5 pm	7
9/5/11	Kafrul S&D Division	Load Management, Transformer repairing, Power Factor Monitoring & Upgrading	Engr. Tanvir Ahmed Asst. Manager	Theoretical & Practical	9 am to 5 pm	7
10/5/11	Kafrul S&D Division	Line maintenances, Faulty transformer detection	Engr. Tanvir Ahmed Asst. Manager	Theoretical & Practical	9 am to 5 pm	7
11/5/11	Kafrul S& D	New Transformer Installation, Route Planning for underground 33KV line	Engr. Tanvir Ahmed Asst. Manager	Practical	9 am to 11:30 am 1:30 to 7 pm	6.5
12/5/11	Kafrul S&D Division, Digun Grid	Substation Operation, Maintenance and Grid Substation Operation & Maintenance	Engr. Shawkat Ali & Engr. Tanvir Ahmed Asst. Manager	Practical On Ground	9 am to 6 pm	8
13/5/11	Kafrul S&D Division, Digun Grid	Line Maintenance	Engr. Tanvir Ahmed Asst. Manager	Practical	9 am to 5 pm	7
14/5/11	Kafrul S&D & Mirpur 12 Substation	Substation and Line	Engr. Tanvir Ahmed	Practical	9 am to 5 pm	7
17/5/11	Mirpur 12 Control Room	Control Room Operation, Maintenance & Load Shedding	Engr. Md. Rafiqul Alam Jr. Asst. Manger	Practical	8 am to 5 pm	8
18/5/11	DESCO HQ Banani	Technical Activities, Major Projects & Future Plans	Engr. Zulfiquar Tahmid Manager	On Desk	2 pm to 5 pm	3
20/5/11	Mirpur 12 Control Room Substation	Sunstation operation, tripping, controlling	Md. Abdul Mannan Jr. Asst. Manager	Practical	8 am to 5 pm	8
21/5/11	Mirpur Old & DOHS Substation	Substation and grid networkin	Engr. Imrul Kayes Sr. Engr.	Practical	9 am to 5 pm	7

Total Internship Hours = 102.5 hours

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CHAPTER 01

INTRODUCTION

1.1 Company Profile

1.1.1. Background

Electricity plays a vital role in the socio-economic development and poverty alleviation. It is considered as the driving force of all development activities. To alleviate poverty in the face of resource limitations and high population density, Bangladesh requires an economic growth rate of about 10% p.a. to provide employment of its rapidly growing labor force that can not be absorbed by agriculture. In order to achieve this growth rate, availability of a reasonably priced and reliable source of electricity is a prerequisite. Starting from a small base, the power sector in Bangladesh has grown significantly. The installed generation capacity has increased to about 5776 MW (as on October, 2010) from a meager 88 MW in 1971. Electricity generation grew at about 7.5% p.a. during last ten years, compared with average annual GDP growth rate of about 6.0 %. Notwithstanding the progress made to date, Bangladesh's per capita electricity generation of 236 KWh p.a. is still among the lowest in the world. About 42% of the population has access to electricity, which is low even compared to many developing countries.

The power sector in Bangladesh faced numerous problems characterized by lack of supply capacity, frequent power cuts, unacceptable quality of supply, and poor financial and operational performance of the sector entities. The customer service is not praiseworthy. There have been a number of reforms in the power sector in Bangladesh since her independence, but most of these reforms failed to bring desired improvements in the power sector. The most pressing problem in the power sector has been with the distribution system, which is characterized by heavy system seldom got the priority in reform initiatives.

1.1.2. Dhaka Electric Supply Company Ltd.

- Formed on : November 03, 1996
- Operates under : Company Act 1994
- Authorized capital : 5000 Million (Taka)
- Paid-up Capital : 1271 Million (Taka)
- Shareholder : DESA (OFF-LOADING in Process)

1.1.3. Territory

The area under service of Company is about 220 square kilometers which comprises the areas bounded by the Mirpur Road, Agargaon Road, Rokeya Sarani, Progati Sarani, New Airport Road, Mymenshing Road, Mohakhali Jheel, Rampura Jheel connected with the Balu River in the South and East and the Turag River in the West and areas under Tongi Pourashava in the North. Recently "Purbachal Model Town" a Rajuk project, situated on the east side of the Balu River and adjacent to Dakshinkhan area, has also been included under the operational area of DESCO.

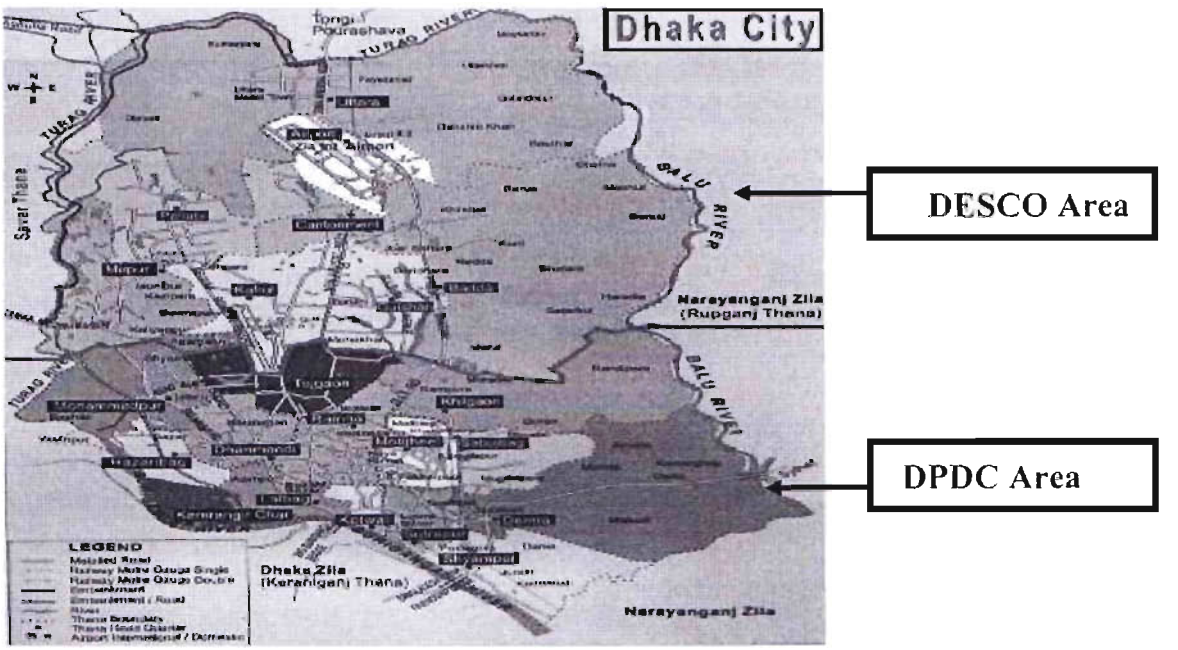

Figure 1.1 : Territory of DESCO

1.1.4 Overall Structure of DESCO

DESCO board is formed by the Managing Director and nine Directors under the Managing Director. Technical Director manages Engineering and system control which is basically divided by two parts as System Engineering and Design and System Control and Protection. Director of Finance manages Finance, Accounts and Procurement which is formed by three sectors.

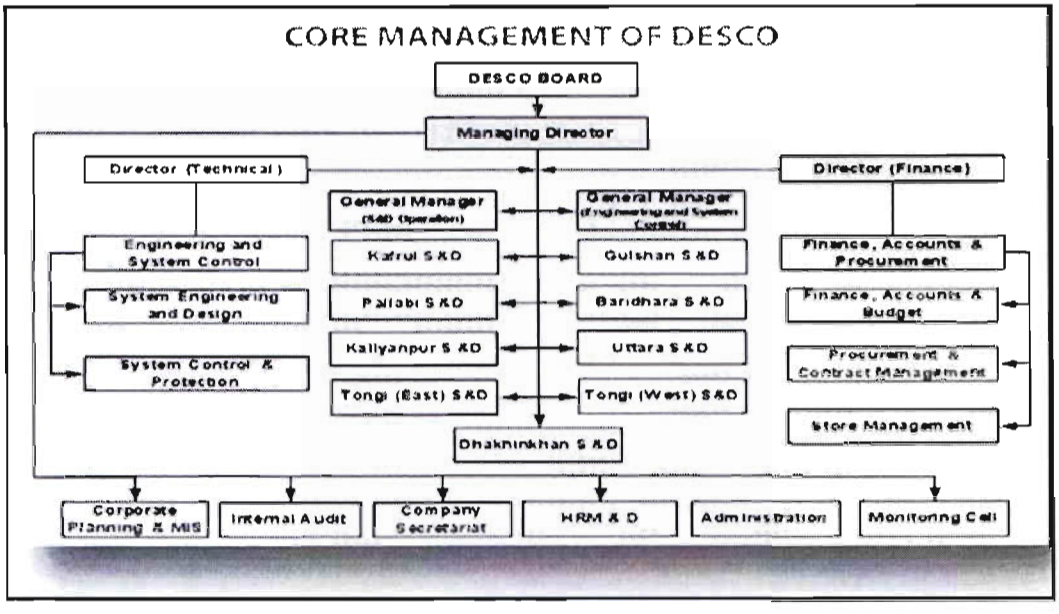

Figure 1.2 : Organogram of DESCO

Source: Dhaka Electric Supply Company Limited

1.1.5. Mission and Vision of DESCO

Vision: Distribute uninterrupted quality electricity using most dependable technologies to the satisfaction of the consumers and to make the company a role model in electric distribution system in the region.

Mission: To be a sustainable and consistent organization in Power Sector, DESCO is working with following missions

- Better Customer Service.
- Provide reliable and uninterrupted power supply to the valued customers.

- Reduce system loss.
- Increase revenue earning to become a profitable business entity.
- Self sufficient in every avenue.
- Better working environment.

1.1.6. Major Works of DESCO

i. Supplying electricity to consumers.
ii. Collecting revenue against electricity usage.
iii. Maintain all the lines, appliances related etc. in the newly developed area and
iv. Existing area fulfill the ever rising demand of electricity.

1.1.7. Supply Chain of DESCO

DESCO purchases electricity from Bangladesh Power Development Board (BPDB), authority responsible to generate electricity. Electricity is transmitted from the Power plants to DESCO's receiving sub-stations through the National Grid. Power Grid Company Bangladesh Limited (PGCB) is in-charge of the National Grid and they receive wheeling charge for transmission of electricity through the National Grid DESCO distributes electricity to the consumers through its own distribution network and collects revenue against the electricity usage.

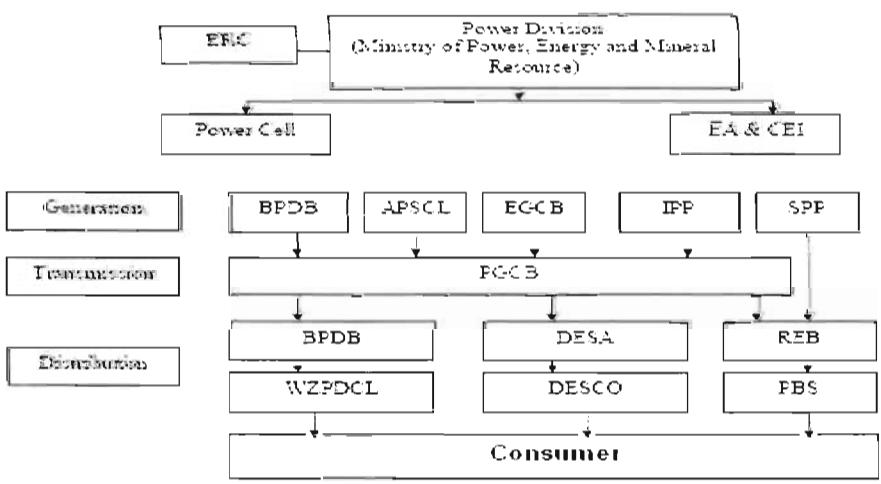

Figure 1.3 : Supply Chain of DESCO

Owner & Regulator

Owner and Regulator is the Power Division, Ministry of Power, Energy & Mineral Resources.

Generation

i. Bangladesh Power Development Board (BPDB)
ii. Rural Electrification Board (REB)
iii. Ashuganj Power station co. Ltd (APSCL)
iv. Electricity Generation Company of Bangladesh Ltd. (EGCBL)
v. Independent Power Producer (IPP)
vi. Small Power Producer (SPP)

Transmission

Power Grid Company of Bangladesh Ltd. (PGCB)

Distribution

i. Bangladesh Power Development Board
ii. Dhaka Power Distribution Company Limited (DPDC)
iii. Dhaka Electric Supply Company Ltd. (DESCO)
iv. Rural Electrification Board through Rural Electric Co-operatives, Palli Biddyut Samities (PBS)
v. West Zone Power Distribution Co. Ltd (WZPDCL).

1.1.8. Distribution System Loss

DESCO acts as a electricity distribution company in the power supply chain. So distribution system loss is the big factor for it. System loss means the percentage change in the energy sales and energy purchase. From the beginning DESCO remains the only company that draws profit to the Bangladesh government. The main reason of that DESCO is showing constant improvement in reducing system loss. At the beginning, in 1997-98 the system loss was approximately 46.67% but in 2011 it is reduced to 8.80%, which is lowest among all the electricity distribution companies of Bangladesh.

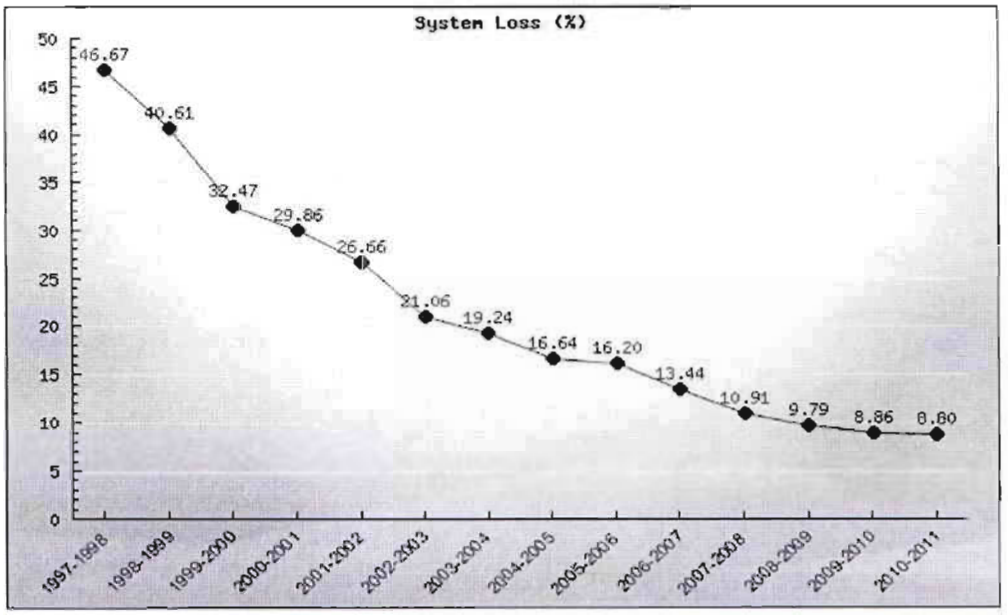

Figure 1.4 : Fiscal year wise system loss (upto May 2011)

Source: Yearly Financial Progress report of Dhaka Electric Supply Company Limited to ADB

1.1.9. Consumer Mix

According to the Annual Report of year 2010 the consumer mix of DESCO is given below.

Category	Consumer Number	(%)
Residential	393639	88.23
Industrial	5979	01.34
Commercial	36957	08.28
Other	9554	02.15

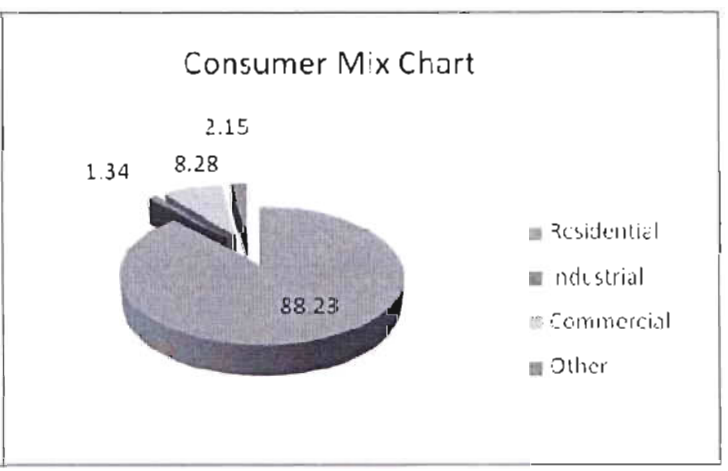

Figure 1.5 : Consumer mix of DESCO based on the annual report of 2010

Source: Yearly Financial Progress report of Dhaka Electric Supply Company Limited to ADB

1.1.10. Consumption pattern

According to the Annual Report of year 2010 the consumption pattern of DESCO is given below.

Category	Consumption (MkWh)	(%)
Residential	1315.766	49.21
Industrial	1016.295	38.02
Commercial	258.421	09.67
Other	83.205	03.10

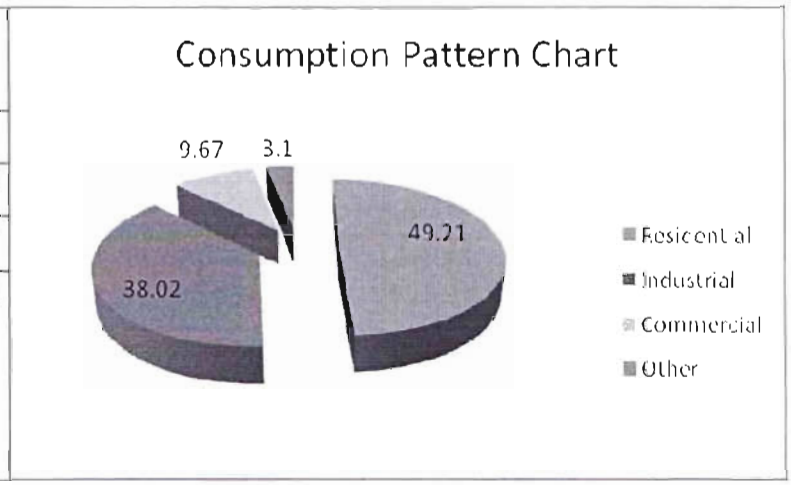

Figure 1.6 : Consumption Pattern of DESCO based on the annual report of 2010

Source: Yearly Financial Progress report of Dhaka Electric Supply Company Limited to ADB

1.1.11. Energy purchase rate and selling rate of DESCO

- Purchase rate from PDB: 2.62 TK/KWH
- Wheeling Charge to PGCB: 0.05 TK/ KWH

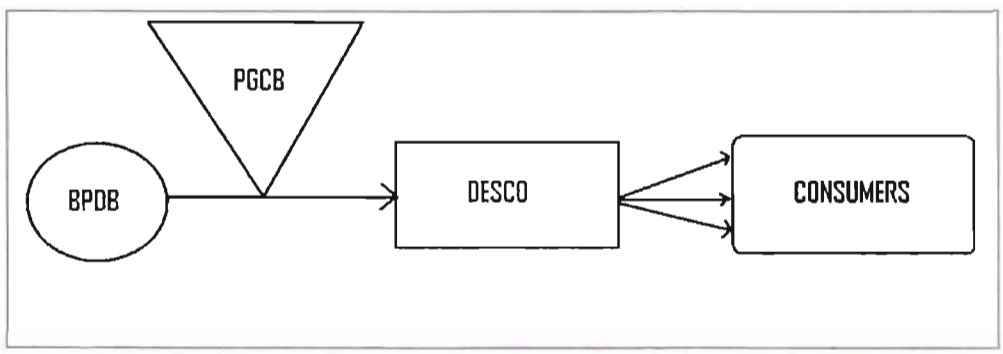

Figure 1.7 : Electricity Flow Diagram

Table 1.1 : General information of DESCO

Sl. No.	Particulars	Present status	Project upto2013
1	Source line(33 KV)	293 KM	350 KM
2	Distribution line(11 KV)	3066 KM	3652 KM
3	No. of Substation(33/11 KV)	22 Nos	31 Nos
4	Installed capacity	770/1078 MVA	1240/1736 MVA
5	Max demand	581 MW	830 MW
6	Load factor	66.05 %	
7	Distribution Transformer(11/0.4 KV)	4830 Nos	6047 Nos
8	No. of feeder	212 Nos	310 Nos
9	132/33 KV Grid S/S	07 Nos	10 Nos
10	System loss	7.34 %	6.5 %
11	Sales and Distribution Division	9	17

1.2. Objective of the Internship

The general objective of the internship was to survey the distribution system of DESCO and to know its operational activities. Some other specific objectives include:

1. To explore the main operational activities of DESCO.
2. To survey the distribution system of DESCO.
3. To find out the success and failure of DESCO in doing its operational activities.
4. To find out the already taken initiatives of DESCO to improve overall performance.

1.3. Scope & Methodology

This study was undertaken aiming to know about the distribution system and operational activities of DESCO. The scope of this study includes reviewing the technical, commercial and customer service quality of DESCO and identifying tolls and techniques used by DESCO to achieve remarkable performance level.

The methods from where we collect the necessary data and remarks. We found very strong information from various kinds of source. It helped us to tie up our report very much.

1.3.1. Nature of the study

The study was mainly descriptive in nature as it focused mainly on information provided by the different departments of DESCO and some other agencies-related to Power Sector. Previous annual reports of DESCO were used as the main study material.

1.3.2. Data Collection

Both primary and secondary data sources had been used in preparing this report.

(i) Primary Source

Primary data is basically collected from conversations with the key employee of DESCO and due to the practical experience of us in DESCO.

(ii) Secondary Source

Secondary data had been gathered from MIS division, Finance and Accounts Division, Company Secretariat and Planning Division of DESCO; newsletters of Bangladesh Power Development Board (PDB), Power Cell and Ministry of Power, annual reports of DESCO and website of DESCO and books of different authors. The

vast ocean of web was also a good source to study the writing relevant to the study topic.

We did our internship in DESCO, total seven students. According to our advisors we are divided into three teams for our reporting purpose. So we basically focused on those meters which are ensured from our Advisors.

We try to cover the following things in our whole report-

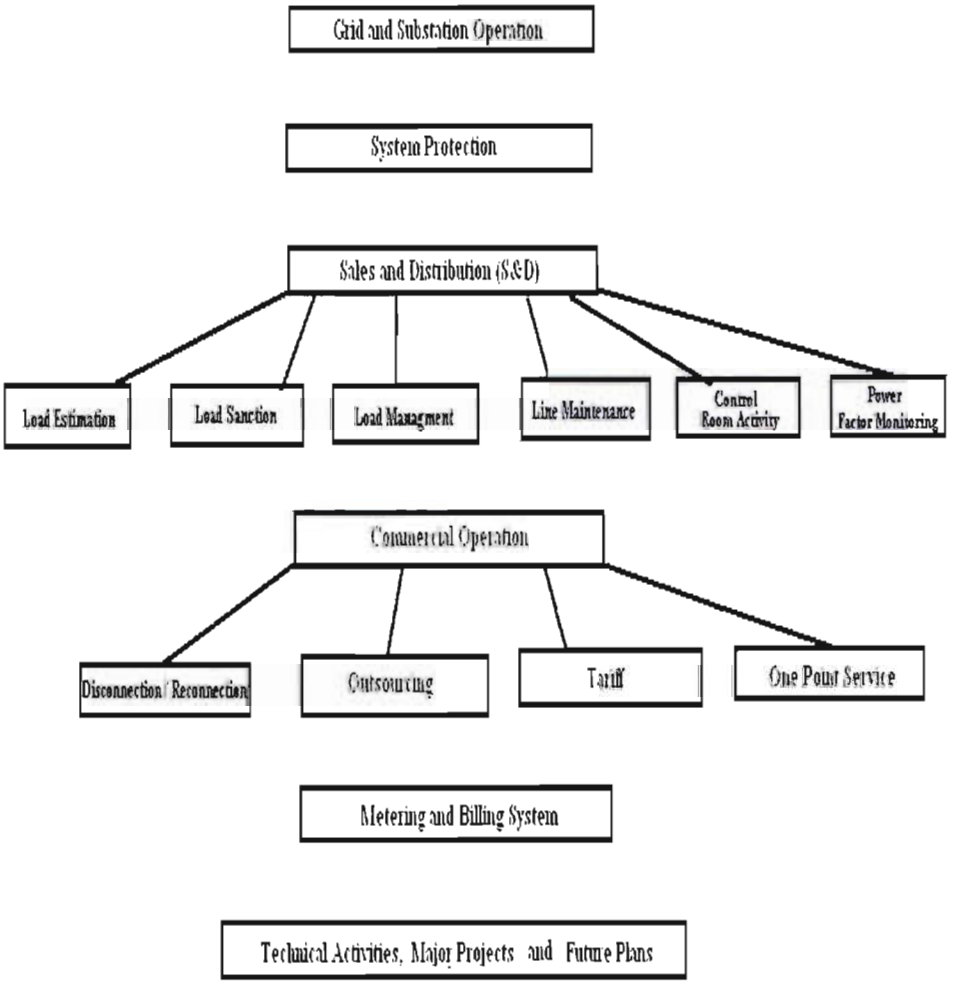

Figure 1.8 : Topics covered in the report

CHAPTER 02

2. GRID AND SUBSTATION OPERATION

2.1. Grid

An electrical grid is an interconnected network for delivering electricity from suppliers to consumers. When referring to the power industry, grid is a term used for an electricity network which may support all or some of the following four distinct operations:

1. Electricity generation
2. Electric power transmission
3. electricity distribution
4. Electricity power management

Figure 2.1 : Grid and substation operation

After generating electricity the electric energy is transmitted to the distribution system through the transmission system. In Bangladesh, usually electricity is generated at 15.6 KV (Kilo Volt) and 11 KV voltage level. To reduce energy loss in the long

distance transmission, the voltage level is raised up to 230 KV in the transmission phase. Near the distribution hubs the voltage level is lowered to 132 KV and 33 KV. In a grid, this transmission from 132 KV to 33 KV is done.

In DESCO, there are three grids.

1. Bashundhara grid
2. Uttara grid
3. Kallyanpur grid (Digun grid)

Among these three, we had the opportunity to work in Digun grid where 132/33 KV transmission is done. The time when we did our intern, Bashundhara grid was out of service but we got our brief idea about the Uttara grid and Bashundhara grid.

When we went to watch the Digun grid and its operations, the instructor provided us a brief idea to understand the planning and the equipments of the grid. We got a huge knowledge about the equipments used in grid like CT, PT, bus Bar, power transformer, grid transformer, circuit Breaker etc. At the beginning, we managed a outlet of a grid substation that helped us to understand about all the connections that belong to the grid substation.

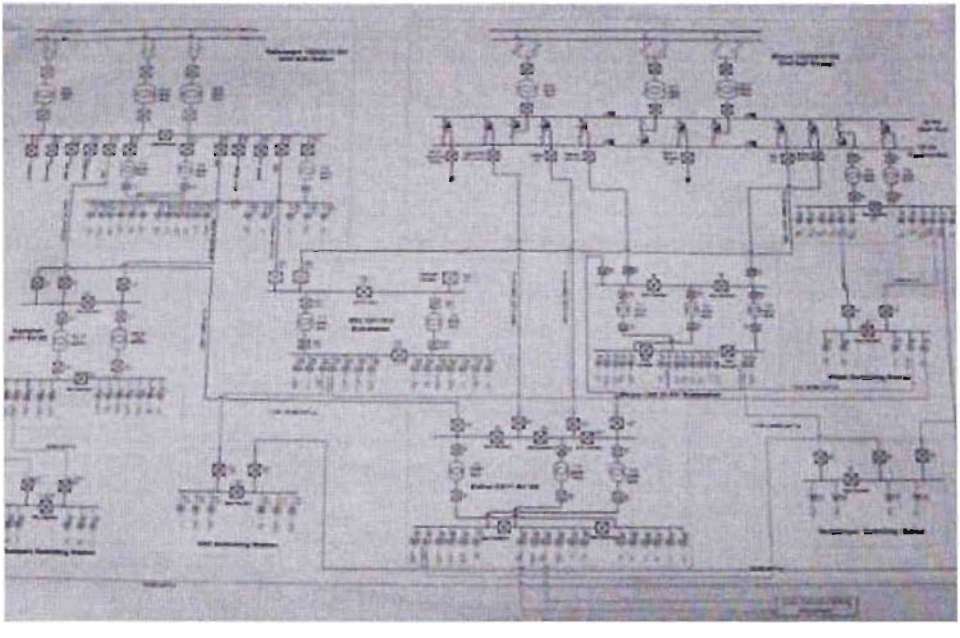

Figure 2.2 : Outlet of grid and substations under DESCO.

2.2. Sub Station

An electrical substation is a subsidiary station of electricity generation, transmission and distribution. Here the system voltage is transformed from high to low or the reverse by using transformers. Electric power may flow through several substations between generating plants and voltage be changed in several steps. A substation that has a step-up transformer increases the voltage while decreasing the current, and a step-down transformer decreases the voltage while increasing the current for domestic and commercial distribution.

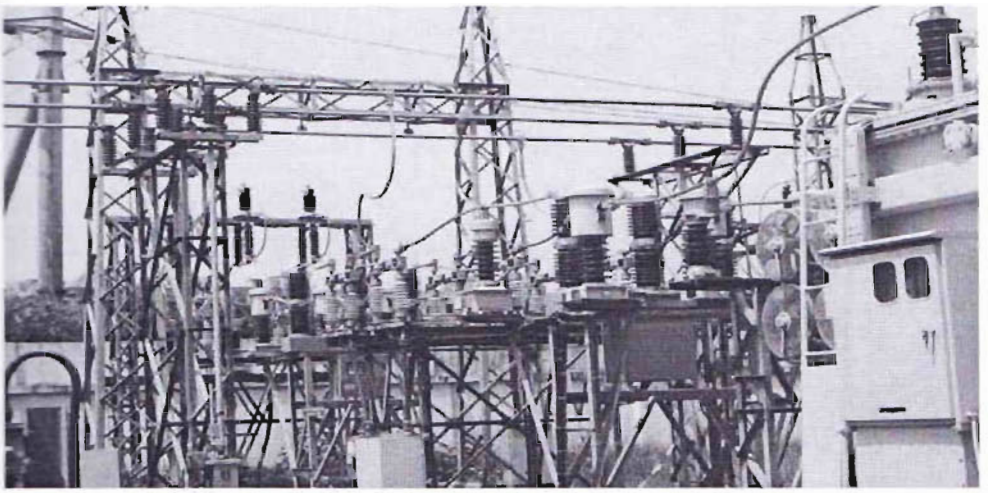

Figure 2.3 : Kafrul Substation (Mirpur), 33/11 KV

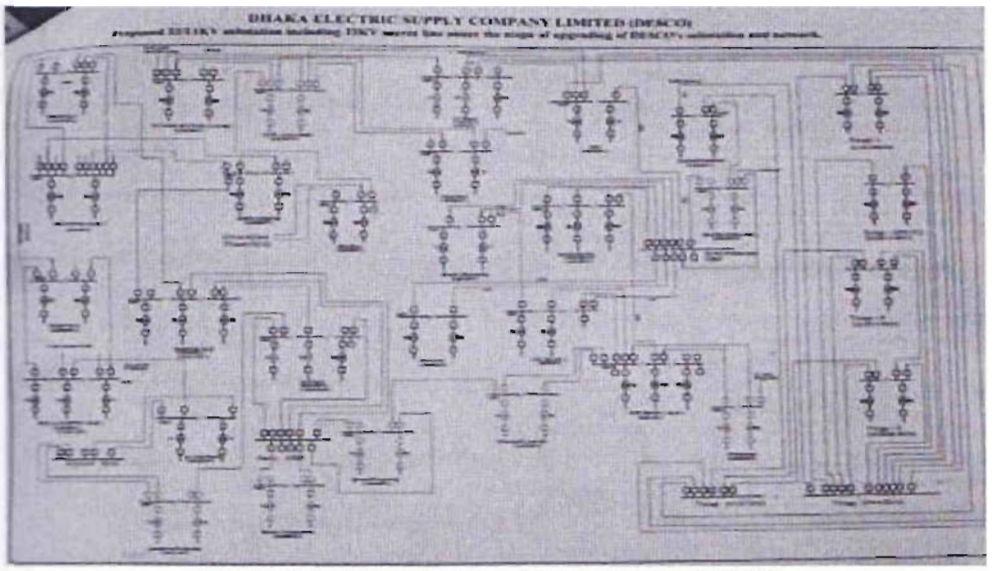

Figure 2.4 : Layout of substations under DESCO

During our internship period, we visited some substations such as Kallayanpur, Kafrul, and Pallabi substations. In these substations, 33/11 KV transmission is done. Kafrul substation is the oldest substation of DESCO and during our internship of first two days it was under construction.

Table 2.1 : Generating Equipments of Grid and Substation

General equipments of Kallanpur Grid	General equipments of Kallanpur Substation
Power Transformer(132/33 KV, 50/75 MVA)	Power Transformer (33/11 KV, 20/28 MVA or 10/14 MVA)
Circuit Breaker(SF6)	Circuit breaker (VCB- 2000A)
Current transformer (CT) (88:1)	Current transformer (CT) (600:1)
Potential transformer (PT) (134/37.5 KVA)	Potential transformer (PT) (33/11 KVs)
Lighting Arrestor (LA)	Lighting Arrestor (LA)
Isolator/ Disconnector	Isolator/ Disconnector
Main Bus bar and Reverse bus bar	Bus bar
Auxiliary transformer(33/0.4 KV, 500 KVA)	N/A
Control relay panel	Control relay panel
AC and DC distribution panel	AC and DC distribution panel

2.3. Brief Description of the components and their operation

2.3.1 Power Transformer

A transformer is a static device consisting of two or more coupled windings, with or without a magnetic core that transfers electric energy from one winding or circuit to another thorough electromagnetic induction based on Faraday's law or electromagnetic induction. According to this law,

Transmission of power is done by electromagnetic induction between the windings or circuits, depending upon the size of the windings, values of voltage and current are changed from primary (source) to secondary (load) with constant frequency.

In DESCO, we learned about power transformer that transforms power from 33 KV to 11 KV where 33 KV is supplied by PGCB. Most of the power transformers are made by Energy Pack and maintained by them as well.

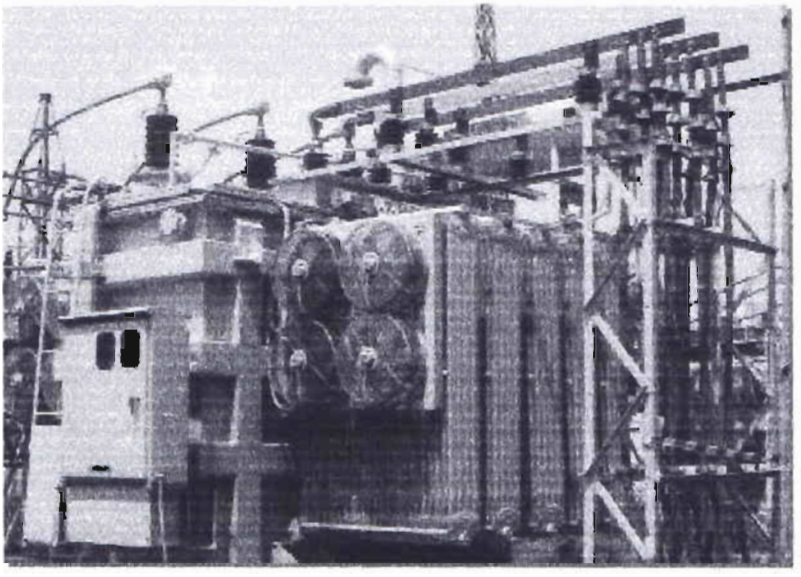

Figure 2.5 : Power Transformer in Kafrul substation

2.3.2. Transformer Principles

- It has two electric circuits called primary and secondary.
- A magnetic circuit provides the link between primary and secondary.
- When an AC voltage is applied to the primary winding (Vp) of the transformer, an AC current will result (Ip), Ip sets up a time- varying magnetic flux in the core.
- A voltage is induced to the secondary according to the Faraday's law.

2.3.3. Grid transformers

In grid, step- down power transformer is used where it transforms the 132 KV generated electricity to 33 KV and transmitted to the substation part. In Bangladesh most of this power transformers are of Oil immerge type transformers. Usually in grid, 50/75 MVA ranged transformers are used.

2.3.4. Substation transformers

Like grid transformers, here also step down power transformer is used where it transforms 33 KV transmitted voltage to 11KV. After this transformation the 11 KV is transmitted to the distribution part where in the transmission lines the distribution transformers take place to lower down the voltage (11 KV to 230 V). This substation transformer has the rating of 20/28 MVA or 10/14 MVA. But the distribution transformers are usually of 200 KVA.

There are various types of transformer but DESCO prefers Oil type transformers. We noted that transformers in DESCO are imported from China. Here are lots of Bangladeshi transformers making companies but China provides transformers at a lower cost than Bangladeshi companies. So China totally captures this market. The main reason of using Oil type transformers is that its parts availability at reasonable price than any other types of transformers.

2.3.5 Oil type transformers components

The main parts of oil type transformer are described below,

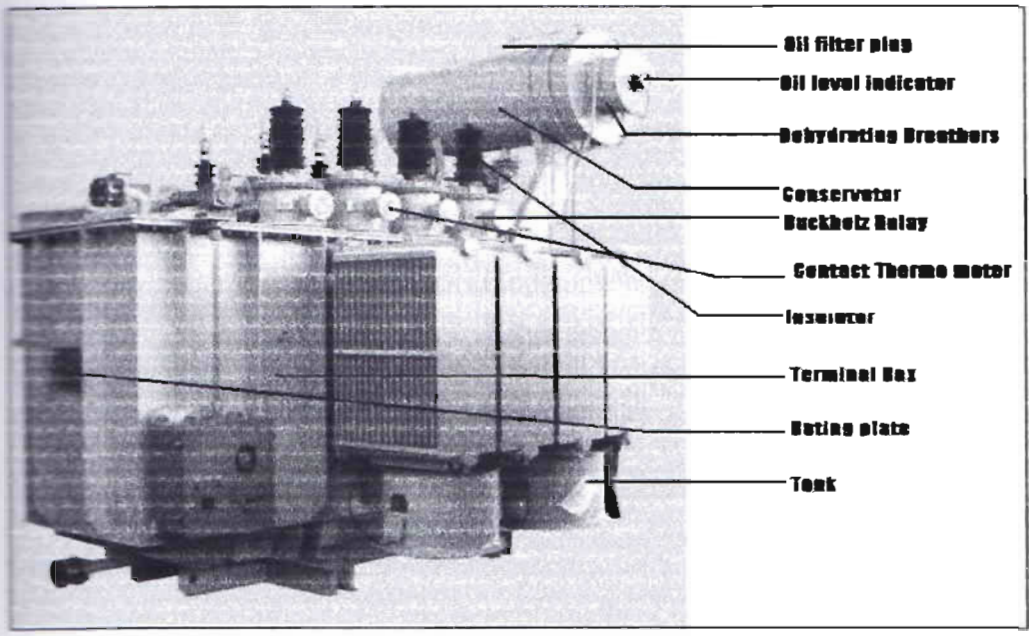

Figure 2.6 : Components of an oil type transformer

During our internship period in DESCO, we passed a special session in Kafrul's transformer workshop dealing with the internal parts of the transformers. The instructor was too helpful that he tried us to make understand the parts of the transformers.

a) Tank and Tank Cover.

This is a metal shield which protects the transformer from the outer sides and gives a look.

b) Primary and secondary windings

Primary winding is for low tension side and secondary side is for high tension side.

c) Terminal

In oil or liquid type transformer, terminal means bringing the electrical connection from the inside to the outside of the tank.

d) Bushings:

Terminal device in form of bushings brings the connection from the transformer insulation medium to the external insulation medium which in most cases is air, but can also be oil in a cable termination box or SF6 in gas insulated switchgear.

e) Cooling system(Radiator and Fan)

The cooling equipment collects hot oil at the top of the tank and returns cooled oil to the lower side of the tank. The inner circuit of the cooling system transfers the loss energy from the surface of the tank. In the outer circuit, the oil transfers the heat to a secondary cooling medium (air).

f) Tap Changer

A tap changer is a connection point along a transformer winding that allows a certain number of turns to be selected. By this means, a transformer with a variable turn's ratio is produced, enabling voltage regulation of the output. The tap selection is made via a tap changer mechanism.

g) Dehydrating Breathers

A dehydrating breather removes most of the moisture of the air, which is drawn into the conservator as the transformer cools down. The absence of moisture in the air largely eliminates any reduction in the breakdown strength of the insulation oil and prevents any build up of condensation (sludge) in the conservator. Therefore, the dehydrating breather contributes to safe and reliable operation of the transformer. It contains a drying agent usually silica gel. The property of silica gel is that it has high absorption power of humidity.

h) Conservator

Conservator is the part of the transformer kept in case of the transformer. In conservator oil expansion is occurred. For this reason usually the oil filled up limit is 50 % of the conservator and rest is kept empty.

2.3.6 Circuit Breaker

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. Unlike a fuse, which operates once and then has to be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

Electric power transmission networks are protected and controlled by high-voltage breakers. High-voltage breakers are nearly always solenoid-operated, with current sensing protective relays through current transformers.

We noted that, high-voltage circuit breakers used on transmission systems may be arranged to allow a single pole of a three-phase line to trip, instead of tripping all three poles; for some classed of faults this improves the system stability and availability. In Bangladesh we observed that SF6 (sulfur hexafluoride) circuit breaker is usually used in the grid and VCB are used in substations.

2.3.7 SF6 Circuit Breaker

Bangladesh grid use SF6 circuit breaker. A sulfur hexafluoride circuit breaker uses a contacts surrounded by sulfur hexafluoride gas to quench the arc. It is used under pressure. It has high electric strength and outstanding arc quenching characteristics. It is an electro-negative gas. It means that the free electrons are attracted to the gas and are not free to move to sustain the arc. Temperatures of up to 30,000 K experienced in breakers. They are most often used for transmission level voltages and may be incorporated into compact gas insulated switchgear. SF6 breakers are used in low voltage system and it can be used up to 1300 KV (rating 45 MVA). SF6 circuit breaker is a control and protection device to the 50 HZ AC and 230 KV and 132 KV power systems in cold climates, supplemental heating or de-rating of the circuit breakers may be required due to liquefaction of the SF6 gas.

Figure 2.7 : SF6 circuit breaker.

2.3.8 Vacuum circuit breaker

With rated current up to 3000 A, these breakers interrupt the current by crating and extinguishing the arc in vacuum container. These are generally applied for voltages up to about 35,000 V, which corresponds roughly to the medium-voltage range of power systems. Vacuum circuit breakers tend to have longer life expectancies between overhaul than do air circuit breakers. We noted that in DESCO, at Baridhara substation,VCB circuit breakers are used.

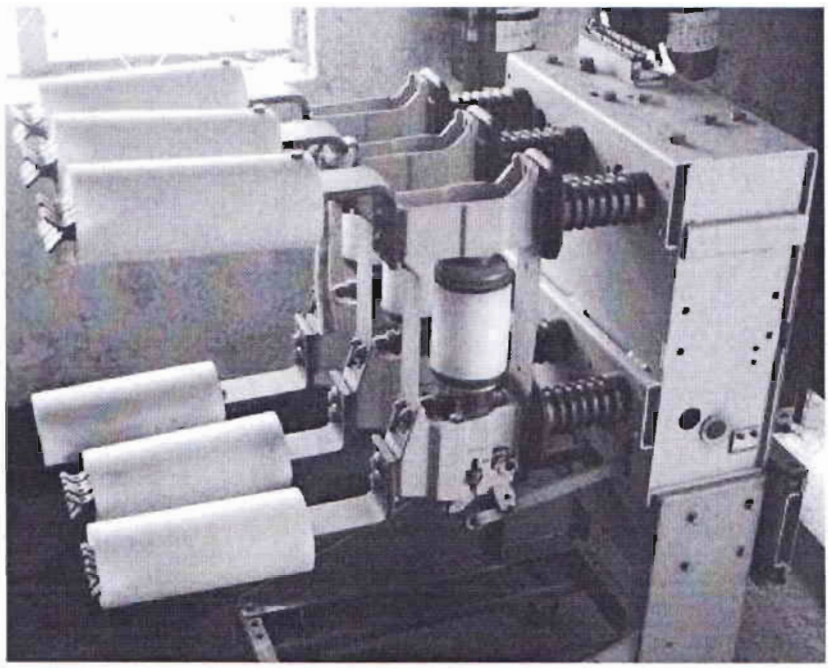

Figure 2.8 : Vacuum Circuit Breaker in Kafrul Substation

2.3.9 Current transformer (CT)

In electrical engineering, a current transformer (CT) is used for measurement of electric currents. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry.

Like any other transformer, a current transformer has a primary winding, a magnetic core, and a secondary winding. The alternating current flowing in the primary produces a magnetic field in the core, which then induces current flow in the secondary winding circuit. A primary objective of current transformer design is to ensure that the primary and secondary circuits are efficiently coupled, so that the secondary current bears an accurate relationship to the primary current. It is connected in series with the bus bar.

The rated secondary current is commonly standardized at 1 or 5 amperes. For example, a 400: 5 CT would provide an output current of 5 amperes when the primary was passing 400 amperes. The secondary winding can be single ratio or multi ratio, with five taps being common for multi ratio CTs.

Types of CT:

1) Protection Class
2) Metering Class

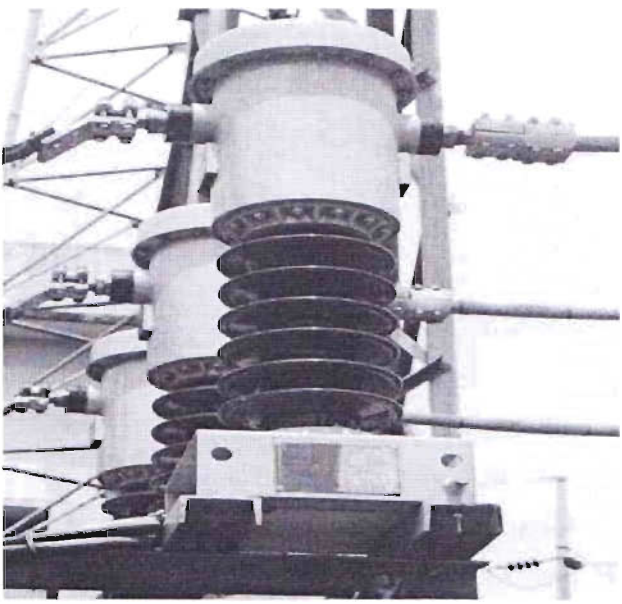

Figure 2.9 : Current Transformer of Mirpur-14 Substation

2.3.10 Potential Transformer (PT)

Potential Transformer is designed for monitoring single-phase and three-phase power line voltages in power metering applications. The primary terminals can be connected either in line-to-line or in line-to-neutral configuration. A PT is a special type of transformer that allows meters to take readings from electrical service connections with higher voltage (potential) than the meter is normally capable of handling without at potential transformer. It is connected in parallel with the bus bar.

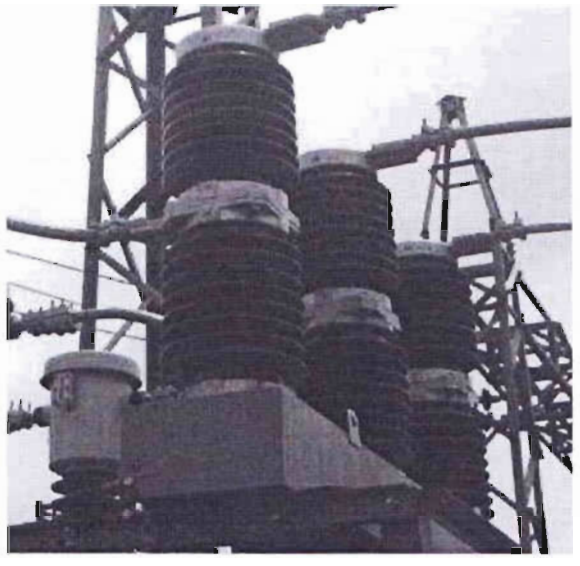

Figure 2.10 : Potential Transformer of Mirpur-14 Substation

2.3.11 Isolator

Isolators are used to disconnect a component of and electrical systems from the power source. Isolator switch is used to make sure that an electrical circuit can be completely de- energized for service or maintenance. Such switches are often found in electrical distribution and industrial applications where machinery must have its source of driving power removed for adjustment or repair. High-voltage isolation switches are used in electrical grid and substations to allow isolation of apparatus such as circuit breakers and transformers, and transmission lines for maintenance. Electrical power distribution system require switching for many reasons including fault isolation, transfer loads from one source to another, isolation of line segments for purpose of

maintenance or new construction, and in some instances for shedding loads. An isolator is essentially a knife Switch and is designed to often open a circuit under no load. In other words, isolators switches are operating only when the line is which they are connected carry no load. For example, consider that the isolator are connected on both side of a circuit breaker, if the isolators are to be opened, the circuit breaker must be opened first.

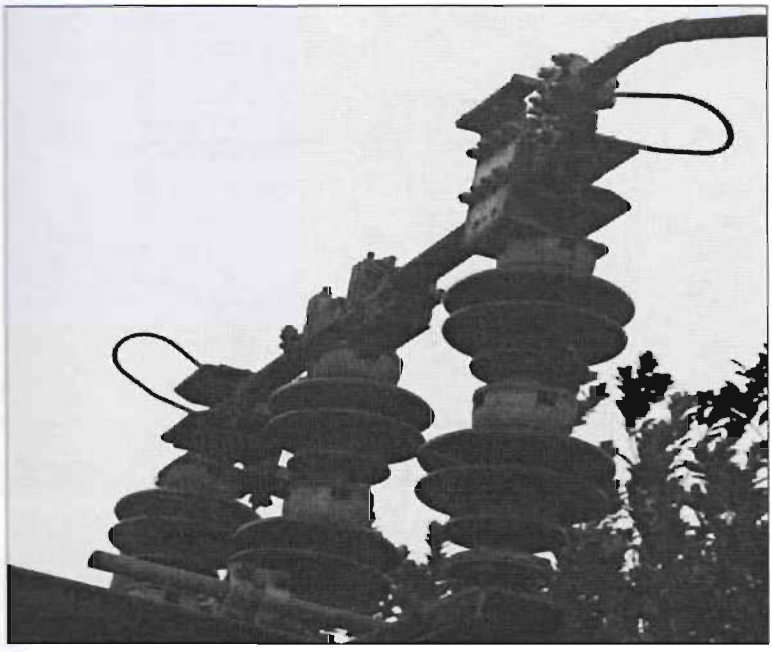

Figure 2.11 : Isolator switch in Mirpur-14 Substation

2.3.12 Lighting Arrestor (LA)

A lighting arrester is a device used on electrical power systems to protect the insulation on the system from the damaging effect of lighting. The typical lightning arrester also known as surge arrester has a high voltage terminal and a ground terminal. When a lightning surge or switching surge travels down the power system to the arrester, the current form the surge is diverted around the protected insulation in most cases to earth. LA are installed on many different pieces of equipment such as power poles and towers, power transformers, circuit breakers, bus structures ,and steel superstructures in substations.

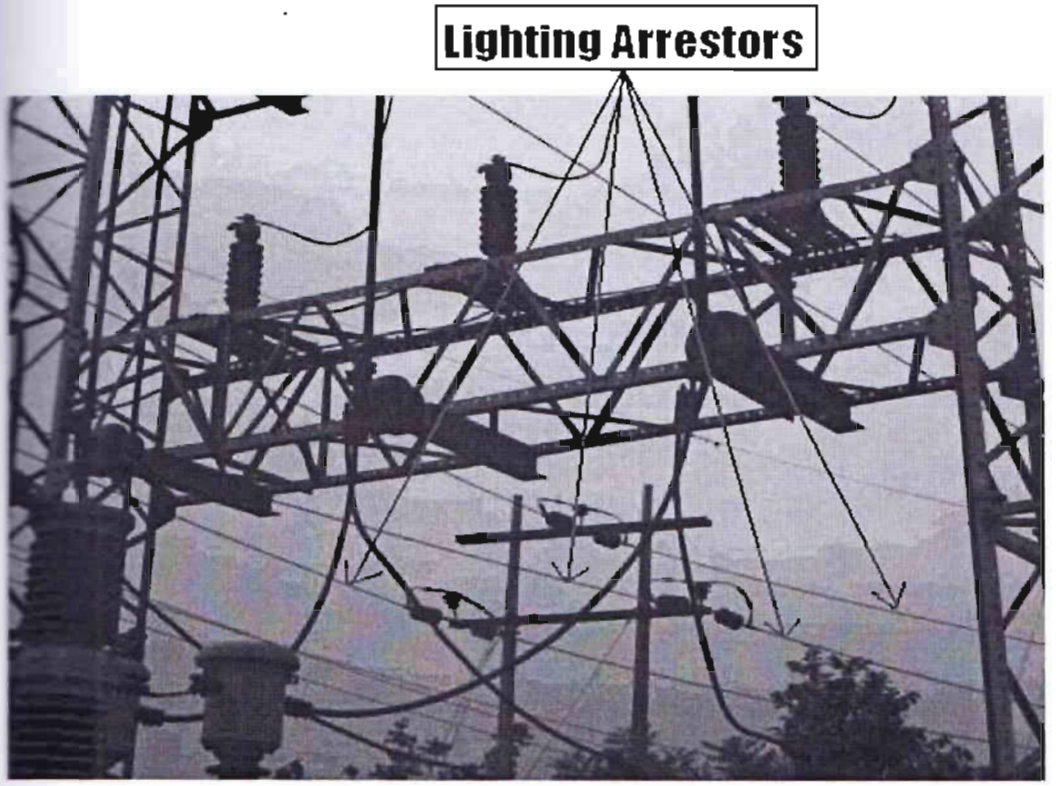

Figure 2.12 : Lighting Arrestors in Mirpur-14 Substation

2.3.13 Bus bar

When a number of lines operating at the same voltage have to be directly connected to the system, bus-bars are used. It is made up of copper or aluminum bars (generally of rectangular X-section) and operates at constant voltage. Generally it consists of two bus-bars a "main" bus-bar and a "reverse" bus-bar. The incoming and outgoing lines can be connected together to bus-bar. However, in case of repair of main bus-bar or fault accusing on it, the continuity of supply to the circuit can be maintained by transforming it to the reserve bus-bar. For voltage exceeding 132 KV, reverse bus-bar is frequently used. In grid there remains a reserve bur as for backup of the main bus.
Actually we had a clear conception about the bus bar system. The instructor showed us how the buses are connected in the substation. We find a similarity between bus bar system and the multi plug system used in our house.

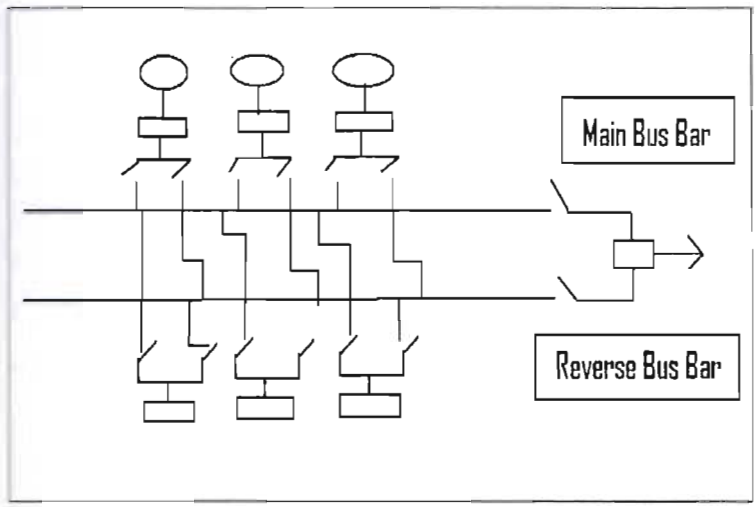

Figure 2.13 : Main and Reverse bus bar system

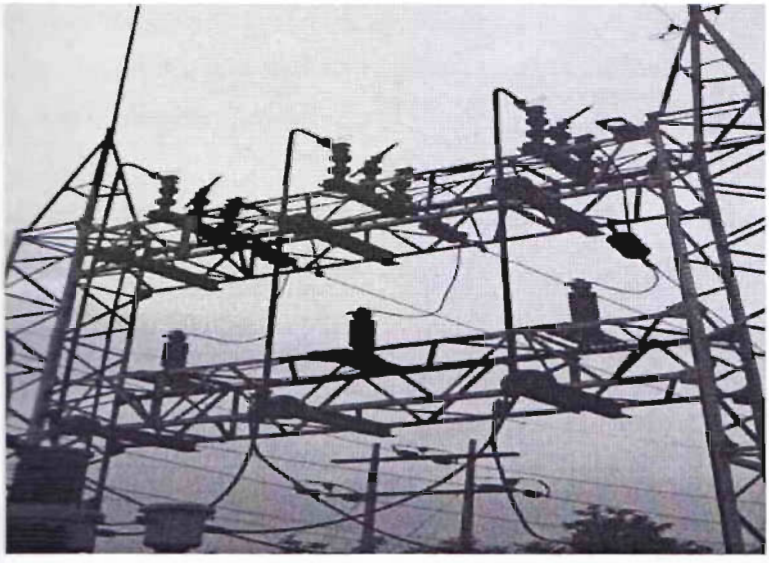

Figure 2.14 : Bus bar system in Kafrul substation.

2.3.14 Auxiliary Transformer

An auxiliary transformer is used to provide supply to the auxiliary equipments and gives supply to the grids or substations own needed power. The grid and substation itself has a maintenance room beside it, so the power supply of that household is provided through this Auxiliary transformer. In grid and substation this transformer transforms 33 KV to 0.4 to continue the maintenance work done of itself.

2.3.15 AC and DC distribution panel

Main power can be lost due to downed lines, malfunctions at a substation, inclement weather, planned blackouts or in extreme cases a grid-wide failure. The building's battery room is generally wired directly to the consuming equipment and floats continuously on the output of the rectifiers that normally supply DC rectified from utility power. When utility power fails, the battery carries the load without needing to switch. With this simple though somewhat expensive system, it is possible for the grid or substation to never lose its power for a moment.

2.3.16 Control Relay Panel

Control and Relay Panels facilitate centralized control of the related controlled equipment in power stations, switching stations and industrial plant. The panels are bolted together to form a board. This approach permits replacements, extensions, rearrangement and addition when necessary.

The panel incorporates control switches and indicator lamps for remote control of controlled equipment. A "remote/ supervisory" selector switch is also provided for selection of supervisory control from remote control centre.

Figure 2.15 : Control panel (kafrul control panel)

2.3.17 Protection Relays

The protection relays are equipped for fault protection of system operation. Protection relays are designed and applied to provide maximum discrimination between faulty and healthy circuits. System equipment will remain inoperative during transient phenomena which may arise during switching or other disturbance to the system.

Types of protection relays which are normally used for system protection include:

- Over current and earth fault protection
- Differential protection
- REF protection
- Standby unrestricted earth fault
- Tripping relay
- Pilot wire protection
- Trip circuit supervision

We have experienced a lot and gathered a huge knowledge about substation operation of DESCO. We also got some idea about DESCO grid operation. We have seen grid and substation maintenance also.

CHAPTER 03

3. SYSTEM PROTECTION

3.1. Protection of Power System

Protection of power system is must because of the normal operation schemes to be continued. It also makes sure of prevention of electrical failure and mitigates the effects of electrical failure. Protection scheme in substation and grid can be divided into three parts:

1. Transformer Protection Schemes
2. Feeders Protection Schemes
3. Bus bar Protection Schemes

We basically focused on Transformer protection schemes because we passed couple of days with that subject during our internship period in Mirpur-14, Transformer workshop. We also got some brief ideas about the protection of feeders and bas bars

3.2. Transformer Protection Scheme

- Grid and substation transformer protection: (20/28 MVA or 10/14 MVA)
  1. Differential protection
  2. Over current and earth fault protection
  3. Buchholz trip
  4. Pressure relief device
  5. Thermal over heating protection
     a) Winding temperature
     b) Oil temperature
- 11 KV distribution Transformer Protections (200 KVA)
  1. Fuses
  2. Over current and short current protection
  3. Earth fault protection

3.3. Transformer Fault and Protection

The types of faults that the transformers are subjected to are classified as:

- **External Faults:**

These are due to overload conditions and external short circuits. Time graded over current & Earth Fault relays are employed for external short circuit conditions. Fuses are provided for Distribution transformers.

- **Internal Faults:**

Internal faults are of two types. These two types of faults are described below:

  - **Electrical Faults:**

Electrical faults are the faults which cause immediate serious damage in the system such as phase to earth or phase to phase faults, short circuits between turns of high voltage and low voltage windings etc.

  - **Incipient Faults:**

Incipient faults are initially minor faults, causing slowly developing damage such as poor electrical connection of conductors or breakdown of insulation etc.

The following relays are employed to protect the transformer against internal faults:

- Buchholz relays
- Differential relays
- Pressure relief relays
- Over current and earth fault relays

3.3.1. Buchholz relays

A Buchholz relay is a gas and oil operated device installed in the pipe work between the top of the transformer main tank and the conservator. The functions of the relay-

1. Detect an abnormal condition within the tank and send an alarm or trip signal. Under normal conditions the relay is completely full of oil.
2. Operation occurs when floats are displaced by an accumulation of gas, or a flap is moved by a surge of oil. Almost all large oil-filled transformers are equipped with a Buchholz relay.

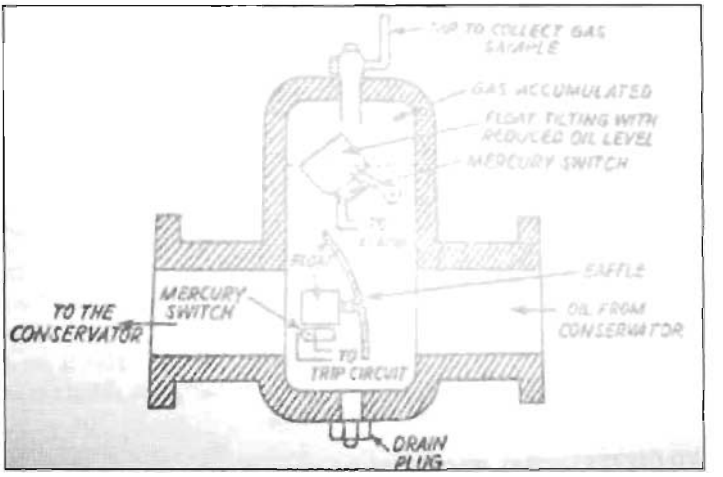

Figure 3.1 : Buchholz Relay

Source: Book of Switchgear Protection and Power Systems, Sunil S. Rao

3. Whenever a fault in transformer develops slowly, heat is produced locally which begins to decompose solid of liquid insulated materials and thus to produce inflammable gas and oil flow. Gas gets accumulated in the Buchholz relay and replaces the oil in the relay.
4. For minor fault, upper float operates the alarm.
5. When a more serious fault occurs within the transformer during which intense heating takes place, an intense liberation of gases results. The gases rush toward the conservator and create a rise in pressure in the transformer tank due to which the oil is forced through the connecting pipe to the conservator. The oil flow develops a force on the lower float and over trips it causing its contacts to complete the trip circuit of the transformer breaker.

Table 3.1 : Types of fault against which gives successful protection

Visible or audible alarm (upper float actuates)	Trip circuit operates (lower float actuates)
Core bolt insulation failure	Short circuit between phases
Bad electrical contacts	Winding earn fault
Local overheating	Winding short circuits
Loss of oil due to leakage	Puncture of bushing
Ingress of air into the oil system	Intense heat taking place

3.3.2. Differential relays

It is a relay that checks for current balance between the primary and the secondary side of a transformer. Here, the currents on each side of the protected apparatus for phase are compared in a differential circuit. Any differential current will operate a relay.

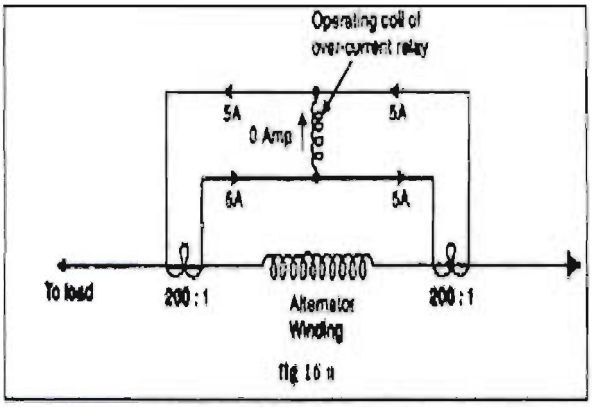

Figure 3.2 : Circuit Diagram of Differential Relay

The functions of Differential Relay-

1. The secondary current that circulates in the coil of the relay for primary and secondary of the transformer cancels each other when the system is healthy.

2. When the fault occurs in a system the balance is disturbed and the resultant current activate the relay and cause trip.

3. This is due to the fact that with no faults within the protected apparatus, the currents entering and leaving are equal to the total current I.

4. If a fault occurs between the two sets of current transformers, one or more of the currents (in a three phase system) will suddenly increase, while that the total fault current will flow through the relay, causing it to operate.

3.3.3. Pressure relief relays

The pressure relief relay or valve (PRV) is designed as a safety device to be used o power transformer. When pressure in tank rises beyond predetermined safe limit, the relay operates and performs following functions.

- Reduces the pressure in the tank by instantaneously opening the connecting port.
- Secondly, along with above mentioned function, it operates a switch which can be used to initiate precautionary electrical system.

Figure 3.3 : Pressure Relief Valve

3.3.4. Over current and earth fault protection

Over current protection includes the protection from overloads. This is most widely used protection. Overloading of a machine or equipment generally means the machine is taking more current than its rated current. Hence with overloading, there is an associated temperature rise. Over current protection of overloads is generally provided by thermal relays.

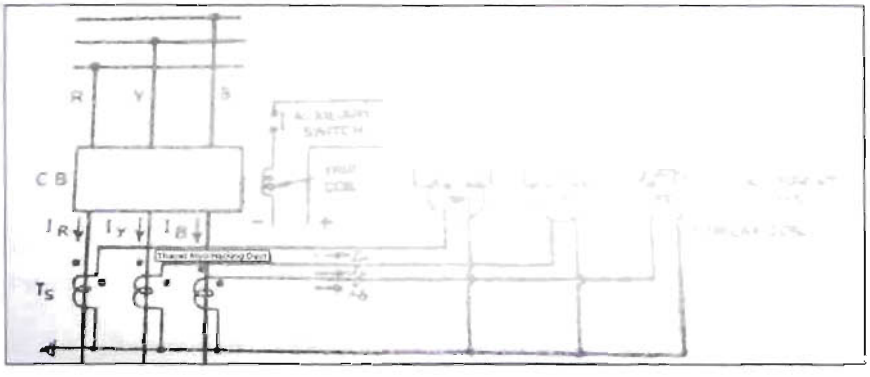

Figure 3.4 : Over current protection with three over current relays

Source: Book of Switchgear Protection and Power Systems, Sunil S. Rao

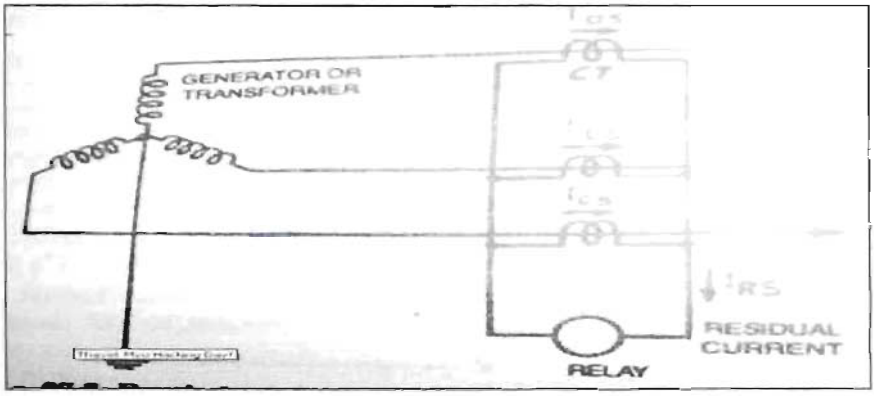

Figure 3.5 : Earth fault protection

Source: Book of Switchgear Protection and Power Systems, Sunil S. Rao

The functions are-

1. Over current protection includes short-circuit protection. Short circuits are phase faults, earth faults or winding faults.

2. The basic element in over current protection is an over current relay which picks up when the magnitude of current exceeds the pickup level.

3. The over current relays are connected to the system, normally by means of CT's.

4. The over current protection is needed to protect the transformer from sustained overloads and short circuits.

5. Induction type over current relays are used which in addition to provide overload protection acts as back up relays for protection of transformer winding fault.

6. The earth fault protection is used to provide protection against any earth fault in the windings of the transformer. It works on the principle that when the transformer winding is sound, the current in all the three phases will balance and no current will spill into the earth fault relay.

3.4. Feeders Protection Schemes

1. Over current (O/C) protection
2. Earth Fault (E/F) protection
3. Pilot wire protection

3.4.1. The working principles of O/C and E/F protection in feeder

1. Main relay will get the sense from CT.
2. Main relay will give sense to trip coil of the Circuit Breaker (CB).
3. Trip relay send pulse to trip coil of the CB.
4. After tripping of CB, main relay will get reset but indication/flag will persist, this is to be reset locally.

3.4.2. Pilot wire protection

1. The differential pilot wire protection is based on the principle that under normal conditions, the current entering one end of a line is equal to that leaving the other end.
2. When a fault occurs between the two ends this condition no longer holds and the difference of incoming and outgoing currents is arranged to flow through a relay, which operates the circuit breaker to isolate the faulty line.

3.5. Bas bar Protection

Buses are essential in both the power system and industrial switchgear. Bus bar protection needs careful attention because-

1. Fault level at bus bars is very high.
2. The stability of the system is affected b y fault in bus zone.
3. The fault on bus bar causes discontinuation of power to a large power to a large portion of the system.

The causes of bus bar faults can be the following-

1. Failure of support insulator resulting a earth fault.
2. Failure of connected equipments.
3. Earthquake, mechanical damage, etc.

Bus bar protection can be done by-

1. Over current Protection.
2. Differential Protection.
3. Directional Protection.

In this section we focused on system protection. For this reason we needed to findout some protection schemes. These are transformer protection scheme, feeder protection scheme and bus bar protection scheme. To explore the transformer protection scheme, we learned a lot about grid, substation and distribution transformer schemes. When we started to deal with transformer protection schemes, two important issues came out. One is external fault and internal fault. To protect internal fault some relays are used such as Buchholz relays, differential relays, pressure relief relays over current relays, earth fault relays etc. All the system protection instruments are automated. But luckily we had an experienced about an exception thunder fault. It is basically a fault of over current. So, the relays should be tripped off automatically and it should give an alarm sound. But, there are some exceptions. We saw that the relay was tripped off but it didn't give an alarm signal. From control room it is always monitored. After a certain time concerned employee give an inspection of all circuit breaker. On his inspection he got that fault and then he retrieved the circuit breaker again.

CHAPTER 04

4. SALES AND DISTRIBUTION (S &D)

4.1. Operation of S&D

The desk-top job and supervisory activities are generally carried out by DESCO employees under its regular payroll while the field operations have been out-sourced. Since its commencement, the field level functions of DESCO have been implemented through separate divisions of system operation and commercial operation. But with the expansion of operational area and fast increase in consumer strength and system load, DESCO took up appropriate steps and created seven numbers of Sales & Distribution (S&D) with the field activities merged under the umbrella of each S&D Divisions. This is a way forwards providing more prompt and better consumer service.

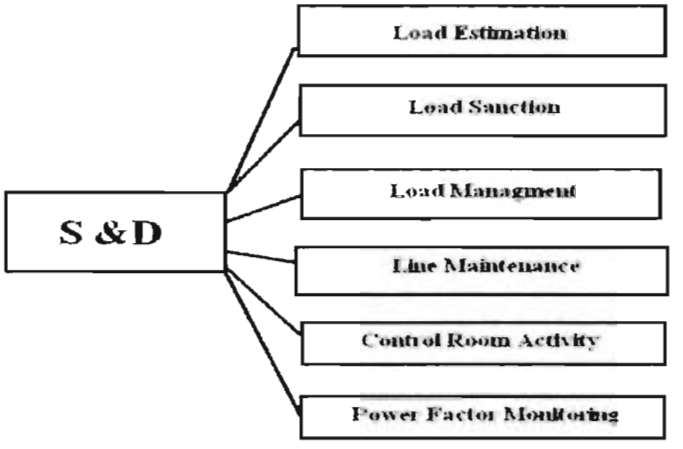

Figure 4.1 : Operation of sales and distribution

There are nine numbers of Sales and Distribution divisions in DESCO. They are-

1) Kallyanpur S&D Division
2) Kafrul S&D Division
3) Pallabi S&D Division
4) Gulshan S&D Division
5) Uttara S&D Division
6) Baridhara S&D Division
7) Dakshin Khan S&D Division
8) Tongi (East) S&D Division
9) Tongi (West) S&D Division

Some other utility service provider in Bangladesh

1. BPDB (Bangladesh Power Development Board)
2. PBS (Pally Biddut Samity) under REB (Rural Electrification Board)
3. DPDC (Dhaka Power Distribution Company Limited), Former DESA (Dhaka Electric Supply Authority)

4.2. Load Estimation

Load estimation is related with some factors. These factors are taken from [Ref.-10]

(a) Load Estimation for installation of transformer factors

- Avoidance of line construction along both sides of a road
- Inadequate clearance between building/installation and electric line
- Inadequate space for line construction/pole erection
- Non-availability of appropriate line route etc.

DESCO shall take measures like avoidance of transformer installation on each pole, minimize the number of transformers in electric distribution line as much as feasible. From the above discussion we can say that DESCO shall consider the criteria of-

- Floor Area of the building
- Load Points in the buildings/premises in estimation of maximum use of load and load Sanction

(b) Load determinants and assessment factors

DESCO takes into account the determinants mentioned below as load points. Once the load points have been recorded, the load estimation shall be conducted on the consideration of assessment factors.

Load Determinants factors:

(i) Light load
(ii) Fan Load
(iii) Socket Load
(iv) Lift
(v) Water pump
(vi) Other Electric Machines/ Equipments/ Appliances

Assessment Factors

Assessment of load will generally depend on a number of factors as specified below but not limited to

(i) Load Point Location
(ii) Connected Load
(iii) Future Load Provision
(iv) Diversity in use

So we can say that, taking into consideration the factors mentioned and declaration of the applicants load requirement the estimation of maximum load use in any building/installation /premise shall be carried out in accordance with stipulations. Tables 4.1 to 4.5 are taken from [Ref.-10].

i) Light Load:

Light load means not so heavy load which are used for bed room, living room, passage, garage, open yard etc. Taken an example from table 4.1 is that, bed room is considered as a single point room and the required load for the point is 100 W.

Table 4.1 : Light Load for various points

Location	Single point room		2 points per room		More than 2 points per room		Estimated Load
	No. of points	Watt per points	No. of points	Watt per points	No. of points	Watt per points	
Bed Room/Drawing room/Living room/ Kitchen room	A	100	B	60	C	40	(A*100)+ (B*60)+ (C*40)
Corridor/Passage/ Toilet/Stair	No. of Points		Watt per points				
	X		60				X*60
Garage/Basement/Ver andah/Garden/Open yard	Y		60				Y*60

Estimated Light Load= [(A*100)+(B*60)+(C*40)+(X*60)+(Y*60) [Watt]

ii) Fan Load:

Fan load is required to estimate the load for various types of fan. If no. of ceiling fan is A, watt per fan points is 70 then the estimated load will become A*70. So table 4.2 is really very helpful to management of the load.

Table 4.2 : Fan Load for various types of points

Type of Fitting/Fixture	No. of Fan points	Watt per Fan points	Estimated load	Remarks
Ceiling Fan/Table Fan	A	70	(A*70)	Load shall be considered
Exhaust Fan/Pedestal Fan	B	90	(B*90)	At actual if installed load exceeds standard load

Estimated Fan load = [(A*70) + (B*90)] [Watt]

iii) Socket Load (Other than sockets to be used for declared equipments.

To estimate the socket load, some issues are taken under consideration. Socket loads are needed for various types of room, garage, garden, open yard etc. There are some socket types such as 2-pin and 3-pin sockets. Actual socket load is determined by calculating single socket point per room, 2 socket points per room and more than 2 socket points per room. Table 4.3 is focused on it.

Table 4.3 : Load Socket points

Location	Socket type	Single Socket point Per room		2 socket points per room		More than 2 socket Points per room		Estimated Load
		No. of points	Watt per points	No. per points	Watt per points	No. of points	Watt per points	
Various types of Room	2-pin	X	200	Y	150	Z	100	(200*X)+ (150*Y)+ (100*Z)
	3-pin	A	1000	B	600	C	400	(100*A)+ (600*B)+ (400*C)
Garage/Base Ment/		No. of sockets			Watt per points			
Varandah/	2-pin	D			150			(D*150)
Garden/ Open yard	3-pin	E			600			(E*600)

Estimated Socket Load=
[(200*X)+(150*Y)+(100*Z)+ (100*A)+(600*B)+(400*C)+(D*150)+(E*600)] * 0.6 (Diversity factor) [Watt]

(v) Lift Load (Lift Load per unit as Kilowatt):

For establishment of lift load, passenger capacity is the big factor. The amount of lift load used depends on the total no. of persons. No load for lift shall be taken into consideration for assessment of total load when no lift is installed but only duct is available for future lift installation. In such case, the applicant shall however be required to furnish a declaration on non-judicial stamp that he/she will duty inform DESCO for total load reassessment and re-sanction thereof prior to installation of lift.

Table 4.4 : Lift Load

Passengers capacity	Load			Remarks:
	Lift to be installed			
	Lift at site	In case of Availability of document	In case of non-Availability of document	At the time of lift installation if the actual load is found to exceed that in Col-3 or Col-5 the same shall be communicated to DESCO by the consumer for total load reassessment and load re-sanction thereof.
1	2	3	4	
4 Person	As per nameplate Rating	As per catalogue/ Drawing	5	
6 Person			8	
Above 6 upto 10 persons			10	
Above 10 Persons			15	

Estimated lift Load= [Col-2*no. of units]+[(col-3/Col-4)*no. of units [Kilowatt]

iv) Electric Equipments/Appliances Load

We know that, equipment runs based on a fixed load applied on it. Some equipment runs higher than specified standard load such as refrigerator, iron, air conditioner etc. Some equipments run based on actual motor rating such as water pump, industrial machine etc. From table 4.5, we noticed that iron needs 1000 watt which is its standard load.

Table 4.5 : Various types of Equipments and their Standard Load

Equipments	Standard Load	Remarks
1	2	3
Refrigerator	100	Actual load already connected to a socket, higher than specified standard shall be considered in estimation of total load.
Television	100	
Micro-Waves Oven	1000	
Washing Machine	500	
Iron	1000	
Air Conditioner	2000	
Electric Geezer	2000	
Electric Heater	2000	
Water Pump	At actual	Based on actual motor rating
Industrial Machine	At actual	Based on actual motor rating
Any other Electric Equipment.	At actual	Based on actual motor rating

Estimated load for Equipments= Col-2*no. of units. [Watt]

4.3. Load Sanction

According to the policy guideline of DESCO [Ref.-10],

i) For the purpose of load sanction for any building/premise, DESCO shall review the applicant's request of load asked for and the total estimated load. The sanctioned load shall not exceed the total estimated load.

ii) Load Sanctioning Authority will be as follows;

Table 4.6 : Load Sanction and respective Authority

Estimated Load	Sanctioning Authority
Below 50 KW	Head of S &D Division
50-250 KW	General Manager(E&SC)
Above 250 KW	Director (Technical)

iii) Prior to sanction of load DESCO shall review various technical issues including the availability of infrastructure for load supply and capacity of the respective distribution Transformer, Feeder Line, RMU, 33/11 KV Substation, 11 KV Switching Station, Grid Substation, etc.

iv) In case of limitations due to technical reasons, DESCO may refuse to sanction load or make partial load sanction till such limitations are overcome.

v) For addition to previously sanctioned load, the conditions mentioned above shall be applicable.

vi) Load sanction will be subject to clearance of any due electricity bill or other bill issued by DESCO for the respective building/installation/premise.

vii) For individual service connections through separate meters under a consumer-supplied transformer, load sanction for each service connection shall be on the basis of the respective estimated load. Load for Common Services form the same transformer will be calculated as follows:

Common Services Load= Sanctioned Load for the building/premise - ∑ Estimated load against individual meters.

viii) For unauthorized use of load beyond the sanctioned load, the provision of electricity tariff rule shall be applicable.

4.4. Load Management

According to the policy guideline of DESCO [Ref.-10],

- Area wise even distribution of electricity according to demand.
- Updated load shedding schedule published in the web should be updated frequently.
- Distribution load shedding evenly throughout different segments of the day rather than continuing it at a stretch for hours.
- Increasing vigilances to shutting down markets, shopping malls etc.
- Increasing customer awareness to reduce misuse of electricity through electronic and print media.
- Creating awareness among the people to use energy efficient electric equipment. Viz. energy efficient bulbs.
- Building its own supervisory control and Data Acquisition System (SCADA) to manage its loads a single point.

4.5. Line Maintenance

- Primary survey of the site as per applicant demand by S&D division and drawing, slaking sheet and bill of quantities
- S&D division makes further survey and study the feasibility of the line construction
- Placed for approval to the authority
- After approval job is issued to contractors
- S&D division maintain and monitoring the work of the contractor coordinating with respective S&D division
- Contractors draw material as per requirements. And apply for outage to do the work.

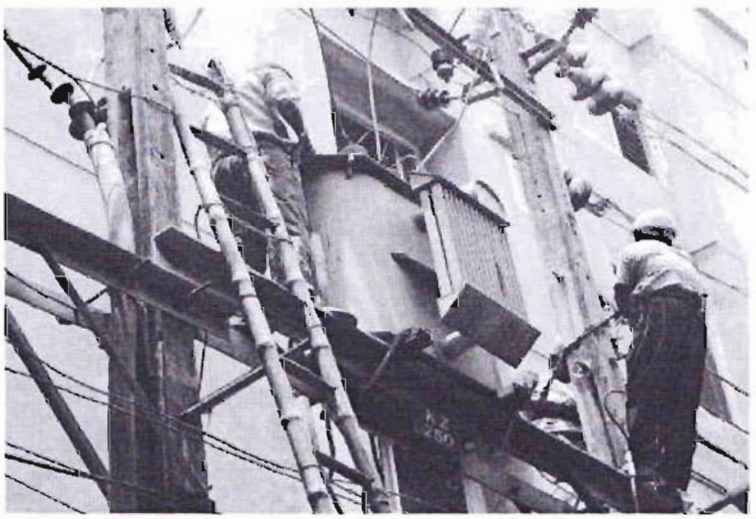

Figure 4.2 : Line Maintenance in Begum Rokeya Sharani,Mirpur

- Joint Inspection Is done after the work has been completed
- Bill is required to pay as per contract with the contractor
- Connection is given from respective S&D

4.6. Control Room Activity

We have done our some programs in Mirpur-14 Control Room. We noted the variation of works in control room. Control Room runs based on four schedules. 9 am

– 3 pm, 3 pm- 9 pm, 9 pm- 3 am and 3 am – 9 am at each day. Actually control room activities are very sensitive, causes a huge damage if a single bit mistake is occurred. The main activities are-

- ✓ Shutdown the respective feeders incase of maintenance any transformer, pole, feeder's line, etc.
- ✓ Maintain a Load shedding chart and give the load shedding for respective feeders.
- ✓ Communicate with the field workers to update about the transmission system.
- ✓ Receive the phone calls and try to solve the relevant problems.
- ✓ Control the 33 KV feeder panels.
- ✓ Maintain the routine check for all the equipments.

4.7. Power Factor Monitoring

Power factor means the cosine of angle between voltage and current in an alternating current circuit.

It can be expressed as,

Power Factor = Real Power (in KW)/ Apparent power (in KVA)

All the organizations want to make unity power factor system because of betterment. It may be fluctuated between 0.95~0.99. So DESCO is bounded to have almost 0.95 power factor. If it falls below 0.95, DESCO has to pay a penalty bill to National Load Distribution Centre (NLDC). To improve power factor DESCO uses power factor capacitor.

Figure 4.3 : Power factor cell of 33 KV feeder panel

We have experienced that it is their KPI (Key Performance Indicator) to maintain the operation of S&D properly. DESCO provides total nine S&D. Under the sales and distribution center, some basic operations are designed. These are load estimation, load sanction, load management, line maintenance, control room activity and power factor monitoring. Load estimation deals with some factors; transformer

factors, assessment factors, determinants factors. Based on these factors load is estimated for light, fan, socket, lift and electric equipments. Load sanction and load management are done by the policy guideline of DESCO. Line maintenance is done by outsourcing people contracted with DESCO by tendering. Control room activities are done by four schedules. This is very sensitive work. Power factor monitoring is the checking out that the power factor all the time. It can not be fall below 0.95.

CHAPTER 05

5. COMMERCIAL OPERATION

Co-operation and monitoring of all support system to perform to run the system smoothly is the main function of commercial operation.

We observed in DESCO that various types of commercial operation are maintained very strongly. They make a very innovative relationship with the consumer's need, want and demand and they like to sell goods and services relevant with customer's facilities. Commercial operation includes disconnection/ reconnection, outsourcing, tariff and one point service. Each and every sector of commercial operation performs their works very clearly as the betterment of service. Figure 5.1 locates all the commercial operations.

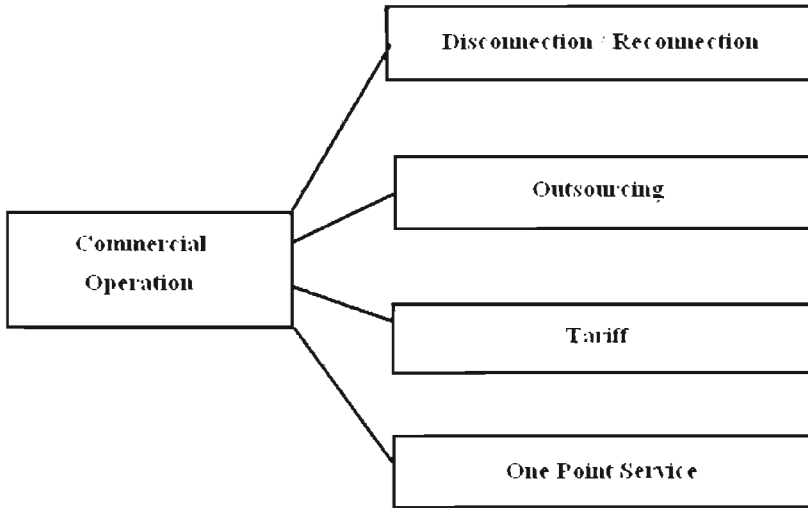

Figure 5.1 : Commercial Operations of DESCO

5.1. Disconnection/ Reconnection

We took part in disconnection/ reconnection work during our internship period. We went Begum Rokeya Sharani, Mirpur for disconnection of illegal connection. We surprised the way people made their illegal connection. Some of them use telephone

wire to carry current from the nearest feeder illegally. Some use illegal heater. The field workers take immediate steps to remove all the illegal connection. The most illegal connections are found in slam areas. Also in some street hotel, cinema hall, tea stalls, etc. These types of illegal connections cause a huge system loss and for these reason loads shedding is increased day by day.

This disconnection/ reconnection process is done by-

1. Engineers of DESCO with some fieldworkers investigate the distribution lines, feeders, transformers, poles, etc.
2. The investigate team maintain their works routine wise. This inspection starts approximately after 12 PM at each day.
3. If any illegal connection is found, they remove all those connections immediately.

Figure 5.2 : Disconnection of illegal connection

4. Sometimes the inspection team fines the responsible public for illegal connections.
5. If DESCO inspection team mistakes during disconnection works, the team reconnect the lines immediately.
6. The public who had disconnected, if they want to purchase electricity form DESCO then they need to apply for service drop to DESCO office and ensure new connection.

Actually DESCO disconnects consumer lines based on the following reason-

- ✓ When consumers do not pay electric bill timely.
- ✓ When consumers use illegal electricity.
- ✓ When consumers are electrically unsafe or insecure.
- ✓ When consumers demand- (a) Temporary D/C (b) Permanent D/C

After all dues are paid by consumer and complete all official formalities then ensure reconnection as early as possible.

5.2. Outsourcing

We informed from DESCO that, in before DESCO used own people to field work. But in that way the probability of crime, system loss, problems were increased too much as the workers of DESCO knew all the key tunnels that they had the chance to spoil the system. So to improve that situation, DESCO promotes outsourcing method and it is selected by tendering after every three months.

Outsourcing activities of commercial operation are-

1. Collect meter reading.
2. Bill distribution.
3. Disconnection and Reconnection activity.
4. New meter and service drop installation.
5. Defective/faulty meter and service drop change.
6. Notice and certificate distribution.
7. Major/Huge meter or consumer related data collect.
8. Disconnection of Illegal connection.

5.3. Tariff

Being a commercial organization, DESCO charges for electricity it distributes on a "cost plus performance based return" principle to cover its capital costs, operation costs as well as to target a post tax return of 15 percent on its equity. It is therefore proposed that, till the recommendations of the tariff study to be conducted with World Bank financing are available, DESCO charge a "cost - plus-fixed- return" tariff from its consumers.

A- Residential	D-Non-resident	G-33/132 KV(DPDC)
B-Irrigation	E-Commercial	H-HT
C-Small Industry	F-11 KV	I(I-1, I-2,I-3,I-4,I-5, I-6)-Utility
		J-Street light

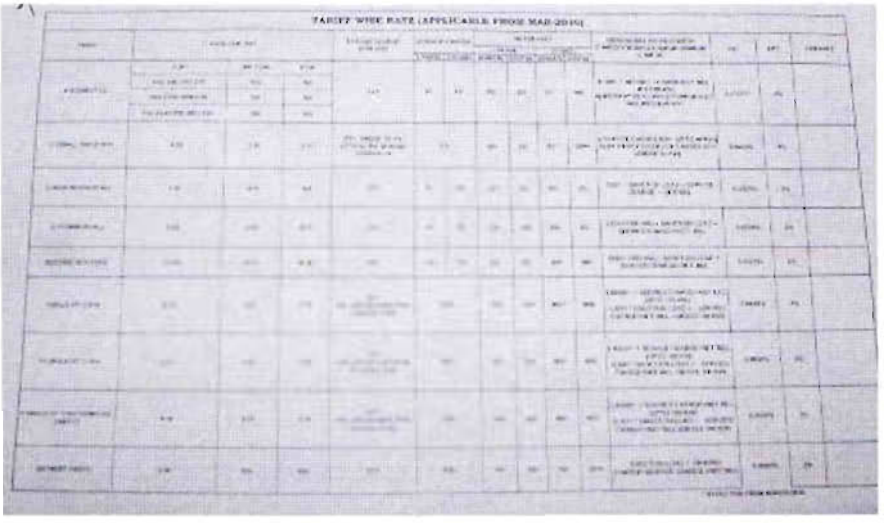

Figure 5.3 : Example of a tariff sheet

5.4. One Point Service

One point service center is the front face/mirror of DESCO. It deals with customers. All types of consumer first come to the one point service center and then apply/collect information as their demand.

We got opportunities to take part in One Point Service centre operations. We passed several times with the Service Centre workers and observed their procedures to handle consumer complains. So we found the way that it deals with –

- New connection
- Load extension or revision
- Service relocation
- Consumer name change or tariff change

- Meter test, change etc
- Bill correction
- Reconnection of disconnected consumers
- Any other commercial related service
- Customer information, awareness activity etc

Main activities of one point service center are-

✓ Receive all type of consumer complaint or information with smiling face.

✓ Possible all service or information are provide to the consumer instantly.

✓ All types of consumer complaint or information are entry in register.

✓ Give the proper guidance to the consumers.

✓ Communication with the consumers for required further information.

✓ Consumer's needs/solution handover to the consumer.

✓ Maintain consumer complain /information record.

DESCO gives highest priority to their consumers. That's why they have developed their standard of commercial operations. For disconnection/ reconnection purpose engineers of DESCO with some field workers investigate the distribution lines, feeders, transformers, poles etc. Outsourcing workers are selected by tendering after every three months to minimize the crime, system loss etc. Outsourcing workers deal with some important works such as collect meter reading, bill distribution, new meter and service drop installation etc. DESCO charges a "cost-plus-fixed-return" tariff from its consumers and designs tariff sheet which is categorized by residential, irrigation, small industry etc. one point service to ensure better consumer support. One point service center directly deals with consumers new connection, load extension, service relocation, bill correction etc.

CHAPTER 06

6. METERING AND BILLING SYSTEM

In this chapter, we discussed about metering and billing system mainly. We observed some types of meter, metering process, unit of meter measurement etc. Metering process is done by two types of meter. Post paid meter and pre paid meter. In our country post paid meter is famous including analog meter and digital meter. Recently pre paid metering system is getting so popular in our country. After this metering system one important issue comes out which is meter reading. After metering and meter reading, billing process takes part.

6.1. Metering

Metering is usually used to read meter reading, that how much load is used by consumers. Through Energy meter the measuring of load used is counted.

6.2. Energy Meter

The energy meter is an electrical measuring device, which is used to record Electrical Energy Consumed over a specified period of time in terms of units.

Every house, small factory, business establishment, shops, offices etc. need at least one energy meter to register in power consumption. The supplier of electricity raises the bill on the basis reading shown by this meter. The producer of electricity sale the electricity to the electricity board and board has to sale this energy to the consumer. Consumer needs to pay the amount against the bill raised by the supplier. The data generate by the energy meter is the base to raise the bill by power supplier.

6.3. Unit of Measurement

The most common unit of measurement on the electricity meter is the kilowatt hour, which is equal to the amount of energy used by a load of one kilowatt over a period of one hour, or 3,600,000 joules. Demand is normally measured in watts, but averaged over a period, most often a quarter or half hour.

6.4. Metering process

In Bangladesh usually two types -of metering is used:

- ❖ Post paid metering
- ❖ Pre paid metering

6.4.1. Post paid metering

The standard business model of electricity retailing involves the electricity company billing the customer for the amount of energy used in the previous month or quarter.

Post paid metering usually refers when the consumers pay the bill after they enjoy their load connection. The meter shows the unit of used energy itself and then DESCO raises the bill on the basis reading shown by this meter. Then the consumers pay the bill according to the reading showed in the meter. Post paid meters provided in Bangladesh are usually two types:

1. Analog Meters (Electro mechanical Meters)
2. Digital Meters (Electronic Meters)

- ❖ **Analog Metering**

The most common type of electricity meter is the analog meter or electromechanical induction watt-hour meter. The electromechanical induction meter operates by counting the revolutions of an aluminum disc which is made to rotate at a speed proportional to the power. The number of revolutions is thus proportional to the energy usage. It consumes a small amount of power, typically around 2 watts.

Figure 6.1 : Analog Meters

The metallic disc is acted upon by two coils. One coil is connected in such a way that it produces a magnetic flux in proportion to the voltage and the other produces a magnetic flux in proportion to the current. The field of the voltage coil is delayed by 90 degrees using a lag coil. This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and voltage. A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc. The equilibrium between these two opposing forces results in the disc rotating at a speed proportional to the power being used. The disc drives a register mechanism which integrates the speed of the disc over time by counting revolutions, in order to render a measurement of the total energy used over a period of time. The type of meter described above is used on a single phase AC supply. Different phase configurations use additional voltage and current a. coils. In Bangladesh usually the analog meters are a range of 450 revolution/ KW} or 800 revolution/KWH

- **Digital Metering (Electronic meters)**

Electronic meters display the energy used on an LCD or LED display, and can also transmit readings to remote places. In addition to measuring energy used, electronic meters can also record other parameters of the load and supply such as maximum demand, power factor and reactive power used etc. They can also support time-of-day billing, for example, recording the amount of energy used during on-peak and off-peak hours.

Figure 6.2 : Digital Meter

In digital meter, the solid-state type of mode is used which make use of a current transformer to measure the current produced in the current-carrying conductors. Which means that the current carrying conductors need not be connected to the actual' measuring device. The measurement is done through pulse counting over this current carrying conductor and according to this the reading is shown. Usually in Bangladesh, the digital meters are of the range in, 1600 pulse/KWH or 3200 pulse/KWH.

6.4.2. Pre-Paid Metering

The Dhaka Electric Supply Company Ltd (DESCO) has started commercial: production of pre-paid electric meters to help enhance government revenue, checking electricity theft and reducing systems loss. They have started commercial production of pre-paid electric in the DESCO factory at Mirpur. Initially the DESCO has involved this metering system in some sectors in Uttara and Mirpur area.

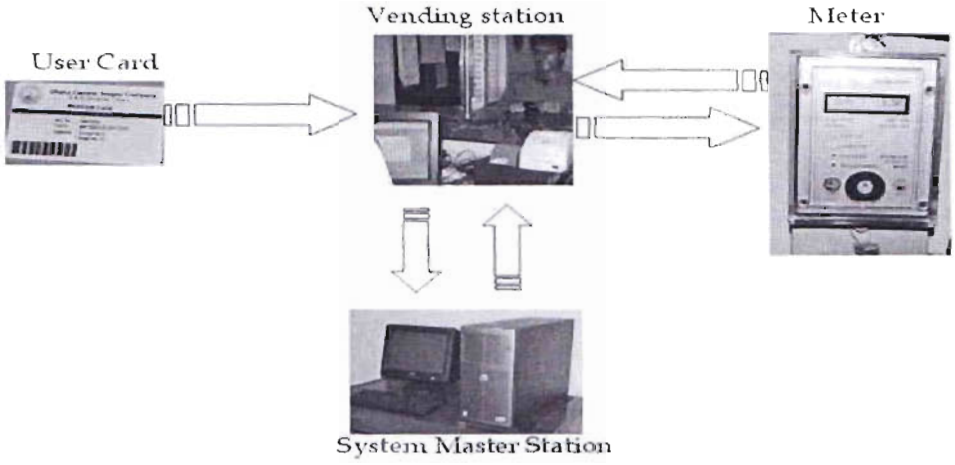

Figure 6.3 : Signal flow of Pre-paid metering system

♦ Pre-paid Metering System

1. The basic principle of payment is to buy Energy in advance and inform the meter in some ways.
2. The credit stored is deducted as per energy usages and the meter will cut the output line as the credit reaches zero.
3. If the consumers buy more credit and recharges, he can enjoy energy usages without discontinuity.
4. Vending Stations are used to sell credit to the consumers.
5. A number of vending stations are connected to a System Master Station (SMS). The SMS is used to process the data centrally.

♦ Working Principle of Pre-paid Meter

This project has a digital energy meter, smart card etc. The meter is connected for the house. If a person has to use the electricity, he or she has to first get charged the smartcard from the vending station for some amount and then they have to insert inside the energy meter.

As soon as the card is inserted the microcontroller is programmed in such a way that it will detect the card and then it will read the amount in the smartcard. The communication between smart card and microcontroller is done through 12C

communication. After reading it will check the total amount with the unit amount (Unit amount is nothing but amount for I unit of power), if the amount is there then the microcontroller will switch on relay which is used to connect the power to the house. Then it will monitor the power consumed and deduct the amount as per the consumption.

If the amount starts to reduce and reaches near to zero then the microcontroller starts to give beeps indicating that the amount is low. If the person ignores this then the microcontroller will switch of the power when the amount is finished. So using this device we can eliminate the energy billing system to the government. Card is recharging from the Vending Station PC, for that a VB front end will be running so that user can enter the amount in PC, the PC will sent the amount details into microcontroller through serial port, then the controller will write the data into smart card using i2c protocols.

6.5. Meter Reading

Most domestic electricity meters must be read manually, by a representative of the power company. The electricity company will normally require a visit by a company representative at least annually in order to verify customer-supplied readings and to make a basic safety check of the meter. The meter reading schedule is being prepared in every month following a definite time table. The chart-schedule contains information of consumer's address by dividing them into Zone, Block and Road.

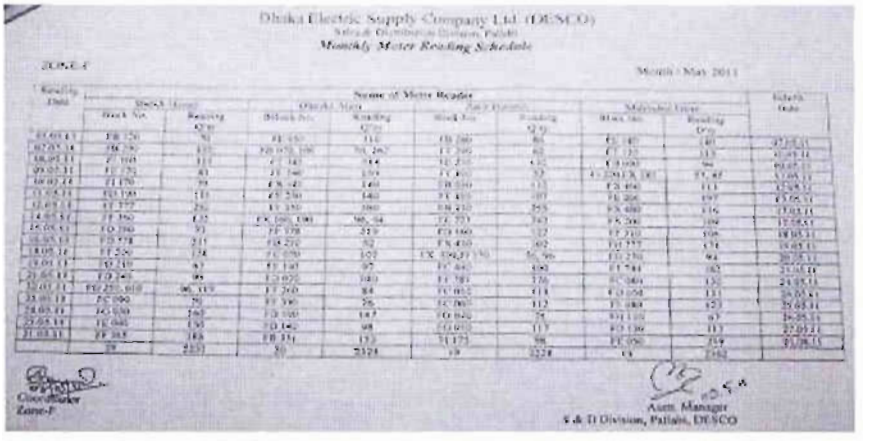

Figure 6.4 : Example of a monthly meter reading schedule

6.6. Meter Tempering by Consumers

Some consumers temper meter very wisely to avoid actual payment of bill. Actual payment of bill is based on accurate meter reading. In this case, meter readers come to check the meter and take the fault reading. If readers can catch the particular consumers with tempered meter then they penalty them calculated that how many days, consumers used these faulty meters.

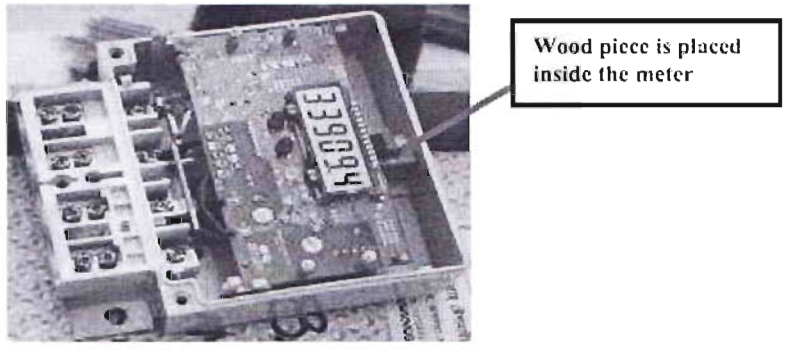

Figure 6.5 : Example of a faulty meter

In DESCO's meter checking room, we noticed the above meter with tempering which caused that as a faulty meter. In this meter a wood piece is placed inside the meter case and a small switch is placed on it. When the meter reader come to take the reading then the meter holder made it pause by using a pin from the outside, so that the meter reader cannot get his actual meter reading.

6.7. Billing

The primary objective of maintaining the financial strength of the Company is achieved by continuous efforts to maintain a healthy billing/ collection ratio.

After meter reading has been taken the meter reading book is being 'submitted to the IT section for preparing the bill. In IT section by two ways, the meter reading is collected. In entry book, by zonal division, according to/ the consumer number and meter number the rated bill is done. After that, again the- billing entry is done in the PC for more accuracy and calculation easiness.

For meter reading purposes the company is committed with some outsourcing constructor from whom the selective ones for every definite place do this work.

Moreover, to make this work more efficient, every effort has been made to change defective meters, sealing of meters and inspection of meters on a regular basis and a meter report is being generated in this basis.

One of the major objectives of establishing DESCO was to improve the revenue/bill collection. Within seven (07) years from its inception. DESCO improved its collection/bill (%) from 59.25 to near hundred. DESCO achieved this performance by notifying the consumers regularly regarding their dues and disconnecting the service connections for not paying the bills after receiving the notices.

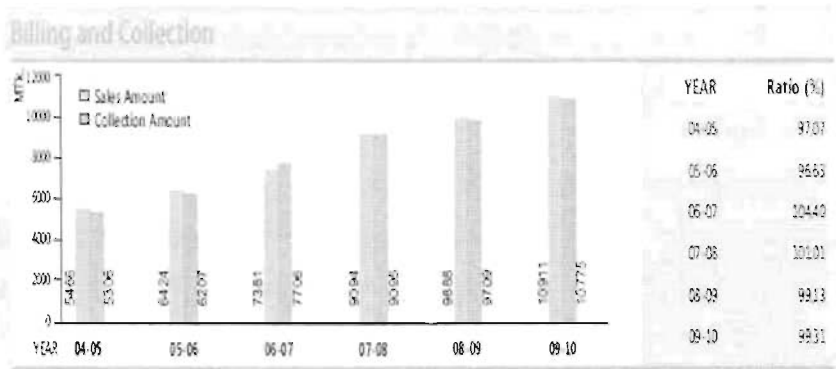

Figure 6.6 : Billing and collection based on annual report 2010 of DESCO

Source: Yearly Financial Progress report of Dhaka Electric Supply Company Limited to ADB.

6.8. Important terms related with Billing and collection

6.8.1. Collection Import Ratio

For a specific period of time-

Collection Import (CI) Ratio =100 - ((System loss % /100) X Collection %)

This is the most appropriate indicator to evaluate the operational performance of a electricity distribution agency or company because it combines indicators of system operation and commercial operation of the company. Usually CI ratio over 90 is treated as very good performance. Considering sales at Tk 10,811 million and collection at Tk 10,737 million, the billing collection ratio of year 2010 worked out at 99.31%. the CI ratio is 90.51% in this year against 89.10% in last year.

6.8.2. Accounts Receivable/Sales

One of the indicators of efficient financial management of any company is decreasing balance of accounts receivable ratio. DESCO maintains a system of continuous monitoring of account receivable by way of monthly report and analysis. The account receivable/sales worked out 20.69% this year against 22.48% last year.

6.8.3. Account Receivable Equivalent Month

At an instant of time -

Account receivable equivalent month = (Total account receivable / Average monthly bill)

This indicator indicates the equivalent monthly bill of account receivable. Usually electricity is sold using post paid billing system. At the end of a month meter reading is collected and based on the reading, the bill is being prepared and distributed to the consumer. 15 days is required to conduct this operation. Again, one month time is given to the consumer to pay the bill. Therefore, Distribution Agency or Company receives the payment against their sales after a period of two months.

We have learned different types of meters and their working principles. Actually we have earned an extra ordinary knowledge about pre paid metering system which is already being installed in Uttara, Dhaka. We have seen new meter installation and how the meter readings are taken by the sub contractors. We have seen a case of meter tempering by a consumer. In billing process, we have checked the comparison between billing and collection ratio based on annual report 2010 of DESCO. We have made us familiar with some important terms such as collection import ratio, accounts receivable etc.

CHAPTER 07

7. TECHNICAL ACTIVITIES, MAJOR PROJECTS AND FUTURE PLANS

DESCO is only the one power distribution company which draws a huge profit than any other power distribution company. In this reason DESCO takes some essential steps to improve technical activities. Recently DESCO works on some major projects, like use of solar power in all installation, 33 KV network planning for 33/11 KV substations etc. DESCO has some future plans to improve its structure more accurately.

7.1. Technical Activities

There are some technical activities in DESCO we observed. DESCO maintains their technical sites very strongly and maximum numbers of employees are working in recognizing the technical structure.

7.1.1. Data Acquisition System (DAS)

DESCO has implemented a data acquisition system. Data acquisition system is integrated remote terminal unit for data gathering and computer –server network which helps.

1. Monitor the real time load status of the network.
2. Implemented rational load shading

Data Acquisition System (DAS) software has been developed by Bangladesh University of Engineering and Technology (BUET).

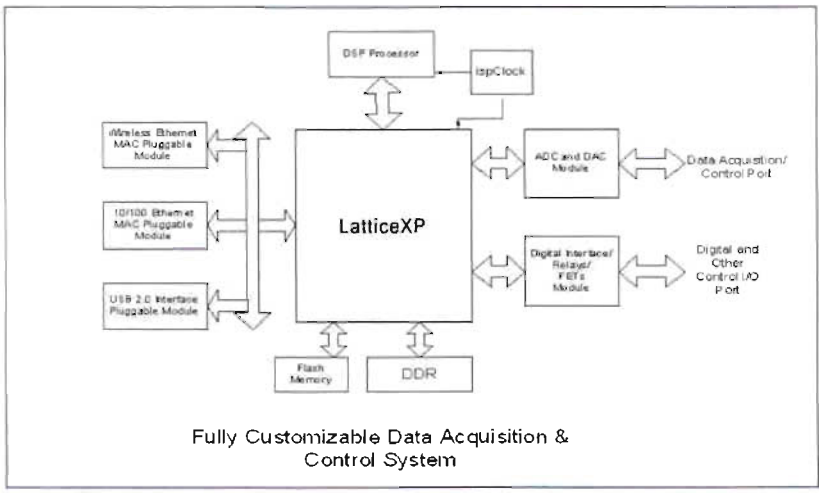

Figure 7.1 : Architecture of data acquisition system

7.1.2. E-Governance System

1. An e-Governance project has been undertaken by DESCO as technical activity.
2. The objective is to create a paper-less office for quick and better management.
3. All of the nine S&D and all other units of DESCO will be interconnected under single network.
4. Data to and from each administrative unit will be transmitted to HQ using the network.
5. All decision on a file will be made electronically.
6. Institute of Information and Communication Technology of BUET is developing the system.

7.1.3. Electronic Bill Payment

To start viewing or paying bills online, consumers first need to login using their bill account number to view their bill, internet payment and other services. Once successful login, simply click on view bill/view outstanding bill to access their DESCO bills.

Pay eBill

- Through mobile phone
  - ✓ Grameen Phone (In process)

- ✓ Banglalink (In process)
- ✓ City cell (In process)

- Through Internet
  - ✓ NEXUS Gateway of Dutch-Bangla Bank

View bill

- ✓ 12-month history of consumers paid bills
- ✓ To take print of consumers bills
- ✓ 12-month history of consumers outstanding bills

7.2. Major Projects

We observed that DESCO has some special major projects. These major projects are listed below,

1. Use of Solar Power in all installation of DESCO
2. DESCO's own security arrangement for KPI installation
3. Installation/ rehabilitation of 33/11 KV substations
4. 33 KV network planning for 33/11 KV substations
5. 11 KV underground line planning for feeders and switching stations.

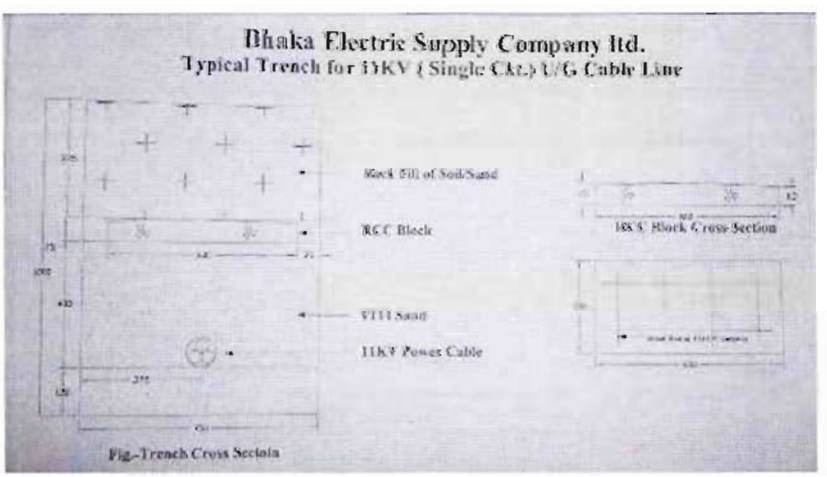

Figure 7.2 : Layout of underground construction for 11 KV line

6. Purbachal new town project.
7. Uttara 3rd phase project.

8. Strengthening DESCO's electric distribution network.
9. Upgrading and expanding distribution system in Gulshan circle.

7.3. Future Plans

DESCO has taken some future plans to remove its all drawbacks. DESCO plans for topographical survey, topographical maps, load survey, load forecasting system, planning of 33/11 substations etc.

7.3.1. Future plan for Topographical survey

I. Collection of geographic map of concerned area.
II. Topographic survey using standard method
III. Production of maps in digitized form using latest version of AutoCAD.

7.3.2. Future plan for Topographical Maps

I. Roads, lanes, by-lanes, pavements.
II. Highways, railway tracks
III. Residential and commercial areas.
IV. Overhead power line poles and towers.
V. Identity number of overhead power lines poles and towers 132/33 KV, 33/11 KV substations and 11/ 0.4 KV distribution substations.

7.3.3. Future plan for survey of Loads

I. Determination of the present load of 33/11 KV substations and maximum demands for the last 10 years from the substations log book.
II. Load of all 11 KV feeders.
III. Future demand of bulk loads/ establishments.

7.3.4. Future plan for Load forecast

I. Historical (Previous 10 years) and present load of 33/11 KV substations and 11 KV feeders.

II. Expected feeder wise load growth rates suggested by DESCO
III. Demand forecast for the project area:

- For 5 years for distribution planning
- For 10 years 33/11 KV sub-stations and substation lines.

7.3.5. Planning of 33/11 KV substations

I. Existing capacity and firm capacity of Substations.
II. Shifting of load from over loaded existing substation on adjacent existing/ proposed substratum.
III. Modification or extension of control room building, equipment foundation, and cable trenches, etc.

7.3.6. Detailed Planning of Distribution network

I. To minimize interruption of power supply.
II. To create facilities for new consumers.
III. To limit voltage drop to the following maximum figures at points farthest from the supply point.

- 33 KV system : 1%
- 11KV system : 3%
- 400/230 Volt system : 4%
- Service drop : 1%

7.3.7. Planning of staking sheets

I. Substation name.
II. Pole numbers and locations.
III. Transformers with KVA rating.
IV. Feeder name.
V. Guy assembly, type and numbers.

7.3.8. Re-arrangement Network

- Every substation has been proposed for two main sources from one grid and one standby source from another grid.
- Overhead sources lines will be replaced by underground line
- Provision for future new substations
- Some existing cables will be rerouted.
- Ring between substations
- Alternative source for substations.

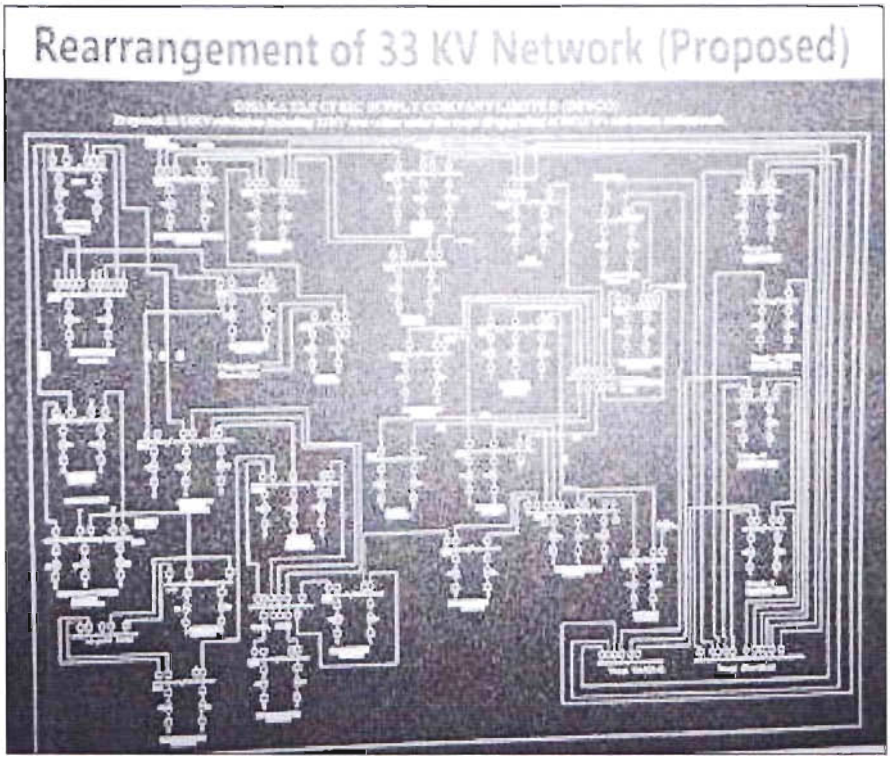

Figure 7.3 : Rearrangement layout of 33 KV Network (Proposed)

DESCO always tries to give better services. To establish better service they have a different wing for future plans. To update their consumers they have a dynamic web portal from which a subscriber can easily view his/her electric bills for any months. To make electric bill payment easy DESCO have introduced CARD PAYMENT System and they are trying to introduce mobile payment method also.

CHAPTER - 08

8. LIMITATIONS AND RECOMMENDATIONS

No one company claims that it is a perfect company. Every company has some drawbacks. To minimize these drawbacks some recommendations should be designed by the respective company to ensure the better services to consumers. In the same way DESCO bears some limitations. Also DESCO follows some recommendations to decline those limitations as well.

8.1. Limitations

Limitations mean problems faced by the company. DESCO faced some problems because of its limitations. The limitations are listed below,

1. Though there are five distribution companies in the power distribution industry and the industry structure for competition is monopoly, therefore consumers in the distribution area are bound to use power from that responsible company distributing power in that territory.
2. Collection of sufficient data was a great problem during report preparation. When DESA handed over the assets and liabilities to DESCO, all of the data, information, papers, design and drawings were not collected accurately and stored properly. As a result shortage of data about any subject becomes a problem.
3. Many data and information have to be collected from different department of the organization. Some of the information were very confidential to the respective department and thus were difficult to collect.

8.2. Recommendations

DESCO should take some special steps to minimize its problems. So DESCO needs some recommendations to have a strong company structure. It should improves its load management, bank connectivity, mobile court activities etc. the recommendations are listed below,

1. Ensured effective Load management.
2. Direct connectivity with the bank.
3. Implementing E- Governance broadly.
4. Enhancing Prepaid Metering System to reduce system loss and wastage of electricity.
5. Expanding mobile court activities.
6. Improvement of One Point Service and introducing Call Center.
7. Conducting Regular Consumer Satisfaction Survey.

It's a big factor for a company to take challenge to minimize its limitations. For the reason of limitations, company has to face various types of problems such as load shedding, system loss etc. The company is best which is more efficient to balance between its limitations and recommendations. DESCO forwards one step because of its balancing manner. DESCO has organized plans to minimize its problems. DESCO collects public opinion to understand where the main lacks are situated, find outs them and try to recover.

CHAPTER 09

9. CONCLUSION

The need of electricity in Bangladesh cannot be expressed in words; the effect of power in each and every growing sector of Bangladesh is undeniable. The economic goals of the country cannot be achieved without flourishing the power sector of Bangladesh. At present, it is way over the time that we still locating the gaps and shortfalls on the power sector, now it is the time to act. A jam-packed plan needs to be implemented as soon as possible to make the power sector effective.

Developing country even the neighboring countries' position is far better than us. For achieving the target government has taken some initiatives to increase the generation of electricity. As power sector is a capital-intensive industry, huge investment will be required for addition generation capacity. Public sector is not in a position to secure this huge investment for power generation. Recognizing these trends, GOB amended its industrial policy to enable private investment in the power sector and Private Sector Power Generation Policy was framed in 1996 for promoting private sector participation in the generation of electricity.

The most important problem of power sector was shortage of fund, lack of long term plan and regulatory or monitory commission. But after creation of DESCO system loss had been downgraded to one digit. This happened because of sincerity of DESCO and their high enthusiasm.

Today DESCO is most profitable organization in Bangladesh in the field of power sector. We had a very good time during the entire period of internship. We have learned a lot of things here. We have sharpen our knowledge about grid and substation, system protection, sales and distribution method, commercial operation, metering and billing system, future plans of DESCO. We had a great experience with them and hopefully this experience will help us in our job life.

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10. Policy Guideline on Load Estimation and Load Sanction of DESCO

Appendix

ADB	Asian Development Bank
BPDB	Bangladesh Power Development Board
CI	Collection-Import
DESA	Dhaka Electric Supply Authority
DPDC	Dhaka Power Distribution Company
DESCO	Dhaka Electric Supply Company Ltd.
FY	Fiscal Year
GDP	Gross Domestic Product
GOB	Government of Bangladesh
GWh	Giga Watt hour
IPP	Independent Power Producer
KWh	Kilo-Watt-Hour
KV	Kilo-Volt
KW	Kilo-Watt
MKWH	Million Kilo-Watt-Hours
MTk.	Million Taka
MW	Mega Watt
PGCB	Power Grid Company of Bangladesh Limited
PBS	Palli Biddut Samity
REB	Rural Electrification Board