INTERNSHIP REPORT

ON

[TECHNICAL TRAINNING AT DESCO]

By

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S.M.Merazuddin [2006-1-80-019]

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Department of Electrical and Electronic Engineering
Faculty of Sciences and Engineering
East West University

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Bachelor of Science in Electrical and Electronic Engineering
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POWER IS YOURS

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August 01, 2011
Memo No: DESCO/Trg. & Dev/2011/ 305

To Whom It May Concern

This is to state that Mr. Ashraful Haque Nirjhar (Student ID: 2006-1-80-003) 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.

DESCO
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August 01, 2011
Memo No: DESCO/Trg. & Dev/2011/ 300

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This is to state that Mr. S.M. Merajuddin (Student ID: 2006-1-80-019) 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.

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ACKNOWLEDGEMENT

In the beginning we would like convey my cordial thanks and gratitude to almighty Allah to complete our Internship successfully. Without HIS assistance I could not have completed our Internship.

We would like to thank S.M.Zamil Haque, Manager (Training & Development), Md. Taqfique Abdullah, Manager Administration of DESCO Ltd. for allowing us to do the internship and work in their team.

We would also like to thank our advisor Dr. Khairul Alam, Assistant Professor, Sharmin Rowshan Ara, Senior Lecturer, and S.M. Shahriar Rashid, 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. We are also grateful to all of our teachers and friends for their cooperation and encouragement throughout our whole academic life in EWU. We would also like to Dr. Kazi Mujibur Rahaman, Associate professor; BUET. We also would like to thank some persons who had 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 Ms.Shabrina Mina,Jr.Asst. Manager, Engr.Md.raihan Arefin DM (C/O),Md. Alamgir, Manager (finance), Engr habibul Hasan Chowdhury, Asst. Manager, (IT), Engr. Mirza Abu Nasaer Dep. Manager, Engr. Tanvir Ahemed, Asst. Manager, Engr Shawkat Ali,Engr. Rafiqul Alam, Jr. Asst. Manager,Engr Zulfiqur Tahmid, Manager, Md Abul Mannan, Jr Asst. Manager

Executive summary:

In the modern world no country can think their existence and long term economic goals without having well-built power sector. Bangladesh has faced various types of problems such as limited generation capacity, poor financial activities and operational performance. In the light of that case the generation of the capacity of power sector is limited, that's why proper distribution is a great problem in our country. This report is based on our internship work which we have done at DESCO (Dhaka electric Supply Company limited). This report focuses on the operation of DESCO, their vision, supply capacity, financial condition, distribution of electricity and future planning. Dhaka electric supply company was created as a distribution company in 1996 under the companies Act 1994 as a public limited company with an authorized capital of TK. 5 million. At present DESCO is one of the main power distribution company in Bangladesh. 75% shares of DESCO are owned by Bangladesh Government and the rest 25% are owned by chairman and other shareholders.

Internship is such a course that gave the opportunity to learn those activities that are related to our real engineering activities which we used to say it was a phenomenal achievement in our educational life. We have learned about grid and substation, transformer and their maintenance and the power factor improvement which were closely related to our study materials. We also sharply observed their administrational activities, control room; complain room operation, IT and one point operation which will help us to visualize the effectiveness in the real life. Here, we also gather some knowledge of corporate world before entering the job field. The details are discussed in the subsequent chapter.

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	Substation 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 networking	Engr Imrul Kayes Sr Engr	Practical	9 am to 5 pm	7

Total Internship Hours = 102.5 hours

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Chapter 01

1. INTRODUCTION

In this chapter we will discuss the background of Dhaka Electric Supply Company Ltd (DESCO), company profile, objective of internship (why were fascinated on DESCO power system) and overview of internship (what we have learnt from internship). Our journey was started on 2, May 2011 from DESCO head office, Banani. At first we went through with S.M Zamil Haque, Manager (Training & Development). He gave a welcome speech to us. He told us the background of DESCO and present status.

1.1. Background of DESCO

To upgrade power sector, Bangladesh Government established DESCO on November 3, 1996. The origin of DESCO was Dhaka Electric Supply Authority (DESA). DESA was established in 1991, but in few years, this organization owned huge loss. Then Bangladesh Government decided to create two new organizations with different management system to distribute electric power in Dhaka city. Those two companies are Dhaka Power Distribution Co. Ltd. (DPDC) and DESCO. To form DESCO, all new honest, smart and energetic employees were picked (and those employees could not come from DESA). Commercial and technical operations were lead by outsourcing.

On September-1998, DESCO distributed power commercially in Mirpur (by Kallayanpur, Kafrul, Pallabi Sales & Distribution Division) with an authorized capital of 5.00 billion taka. After those sequent years of progress, DESCO distribution power network cover almost half of Dhaka city at present. When DESCO started power distribution in Mirpur, system loss was 46.67%, consumer number was 71,161 and load demand was 90 MW.

1.2. Present Status:

According to last 'DESCO ANNUAL REPOERT 2010', total consumer number is 4, 46,129 and load demand is 622 MW. DESCO service area is about 220 square KM. Present shareholders quantity increase from 7,320 billion to 8,760 billion, growth rate is

19.67%, and now 75% shares of DESCO are owned by Bangladesh Govt., 25% shares owned by chairman and other shareholders.

DESCO has nine running S&D divisions and another three S&D are under construction. DESCO has been developed continuously with excellent supervision. Every year lots of new consumers are added in DESCO territory. To handle this huge number of consumer's demand, DESCO has been improving their technical features like extend source line, distribution line and feeder line, increase number of substation and distribution transformer, create expert and smart system/employees to give better service to consumers.

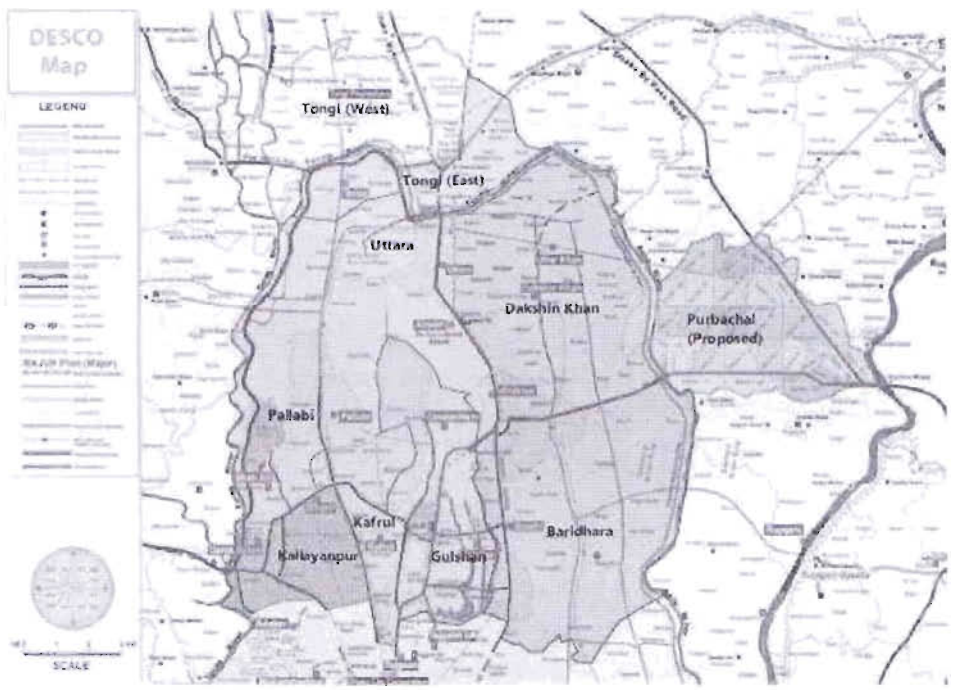

Figure 1.2.1: S&D wise DESCO map.

Now some progresses are shown in graph. All data are taken from '**DESCO Annual Report- 2010**'.

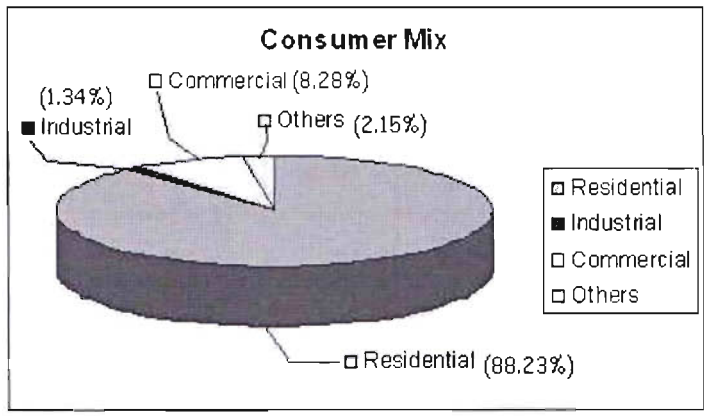

Figure 1.3.1: DESCO's consumer mix in percentage.

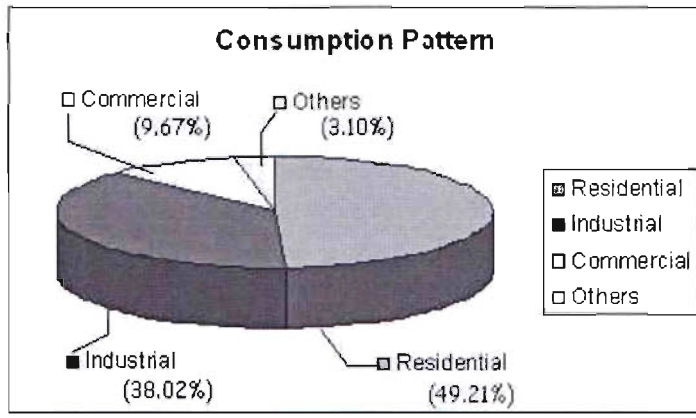

Figure 1.3.2: Power consumption pattern in percentage.

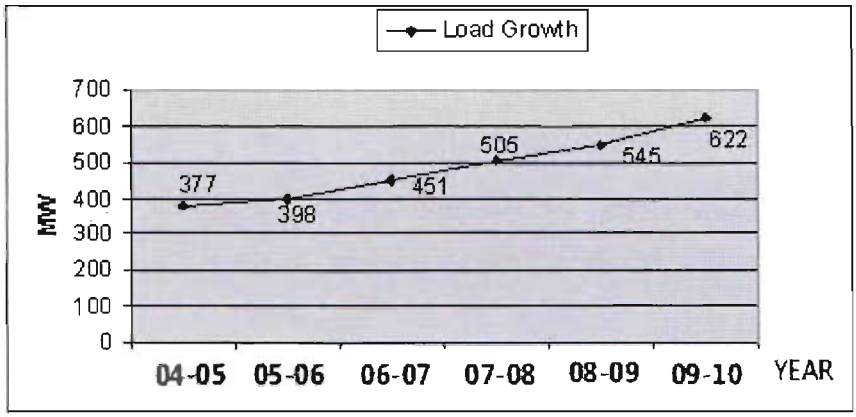

Figure 1.3.3: DESCO's load growth curve.

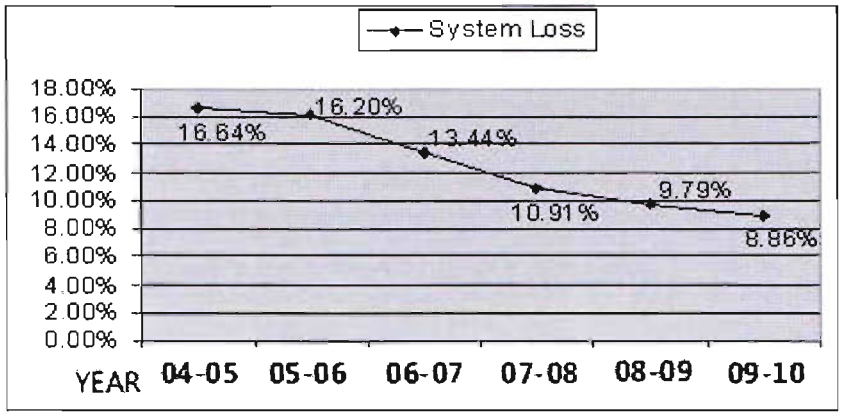

Figure 1.3.4: System loss curve.

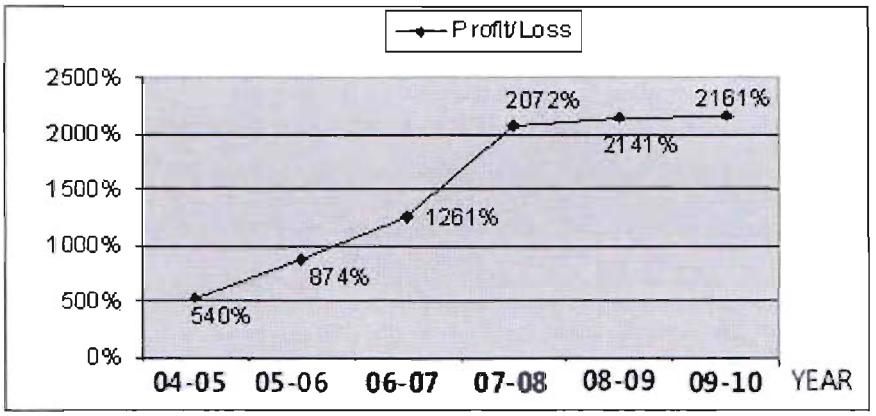

Figure 1.3.5: Profit and loss curve.

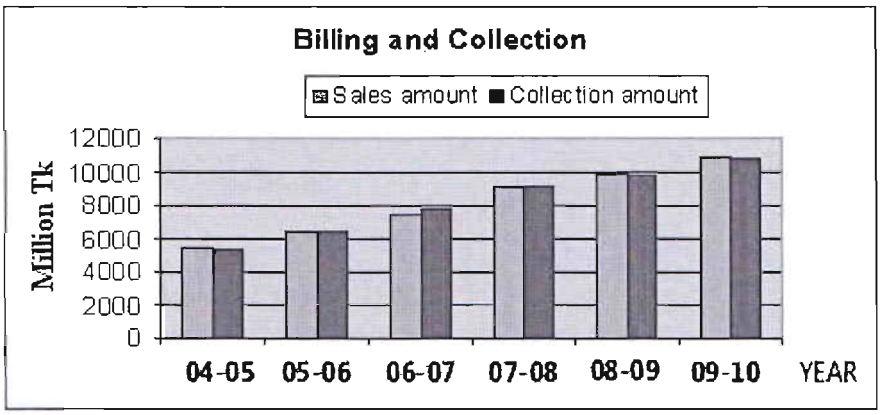

Figure 1.3.6: DESCO's billing and collection.

1.4. Objective of Internship:

Scientific inventions have made this world better living. Modern science has provided us with various means of comforts and luxuries. The invention of electricity is one of the greatest of its wonders. Indeed, we cannot even dream of living in absence of electricity in modern times. There is no walk of life in which it is not used these days; its utility in our daily life is unending. But unfortunately in our country its supply has not been able to meet the demand for it. Since last update, 49% of total population gets electricity service. But our country is quite rich in natural resources which are needed for its generations. By exploiting these resources more of electricity will have to be generated.

To compete with the developed countries, Bangladesh Government is focusing on developing power sector. The primary action was to develop electric supply in Dhaka city. So Bangladesh Government established DESCO (Dhaka Electric Supply Company Limited). When DESCO was established, system loss was 46.67% only in Mirpur area. Now the system loss is 8.86% and covered almost 50% area in Dhaka city. This is a great revolution in our power system. So we wanted to know how this revolution was happened and how DESCO give services. We also wanted to know about DESCO power system, because we are completing major courses on power engineering. From that interest, we applied for an industrial training program to DESCO and it has been approved. We have started our program on May 2, 2011 and end on May 21, 2011. We have known about DESCO administration, management, customer service, field work, substation and its equipment, power distribution system, billing/ collection, revenue etc. Plenty of things we have learnt from this internship, now we can relate our theoretical knowledge with practical experience. This practical knowledge may possibly help us to contribute in our power generation.

1.4.1. Overview of Internship:

Our internship has been started on May 2, 2011 and completed on May 21, 2011. We have completed our internship in 19 days, 102 hours.

Our internship report is divided into six parts to write down our knowledge and experiences. Now the list is shown,

- Administrational activities
- Commercial operation
- Grid and substation
- Technical operation
- Control room and complain room operation
- DESCO's project and future plan

1.5. Administrational Activities:

Mainly Dhaka Electric Supply Company (DESCO) is engaged in the distribution of electricity. This company is involved in many activities such as administration, planning, design, installation, operation and maintenance of power substations and transmission lines. Now Administrational activities are given below:

- Job Specification and Job description of DGM
- Job Specification and Job description of Manager(Logistics& general services)
- Job Specification and Job description of Manager(Security, Estate &Legal affairs)
- Job Specification and Job description of Assistant manager(Recruitment, Inquiry & discipline)
- Job Specification and Job description of Assistant manager(Estate &Legal affairs)

According to the job specification and job description of DESCO has some duties and responsibilities. Following the duties and responsibilities are given for your kind consideration.

1.5.1. DGM (Administration):

- DGM (Deputy General Manager) is the head of this department. His job title is DGM (administration).Office of GM (personal& administration) is the name of the office. And he is controlled by GM (general manager).
- Implementation of all function like Estate, Logistics, Security department, office order, circulars, as directed by authority are the works of GM.
- In additional works are rent, holding &other taxes, office establishment, permanent installation, repair, maintenance of building, land in possession of company etc.
- His qualification will be Graduate in Engineering/ MBA/Masters in any discipline any government University and have minimum 14 years work

experience of which at least 8 years of administrative capacity. Age shall be maximum 45.

- Ultimately DGM is the final decision maker in each and every section of DESCO administration.

1.5.2. Manager (Logistics& general services):

- He is under controlled by deputy general manger (DGM). To implement of all function like Logistics department as per condition of approved service rules and policy guidelines.
- Additionally to issue office orders, circulars, assign. Monitor& control duties, regular maintenance, and control movement of vehicles, to develop and recommend the annual budget and annual plan for the companies are the working sectors of manager.
- His qualification will be Graduate in Engineering/ MBA/Masters in any discipline any Government University and have minimum 10 years' work experience of which at least 5 years of administrative capacity. Age will be maximum 40 years.

1.5.3. Manager (Security, Estate &Legal affairs):

- He is also under controlled by deputy general manger (DGM). To implement of these functions like security, Estate &Legal affairs as per condition of approved service rules and policy guidelines.
- They keep recodes of all office establishments, permanent installation & in procession of the company and also to issue the payment of rents, holding and other taxes monitoring, supervise, and exercise financial authority as per approved financial procedure.
- His qualification will be Graduate in Engineering/ MBA/Masters in any discipline any Government University and have minimum 10 years' work experience of which at least 5 years of administrative capacity. Age shall be maximum 40 years.

1.5.4. Assistant manager (Recruitment, Inquiry & discipline):

- He is controlled by deputy manger. To help deputy manger and establish the service rules and policy guidelines of Recruitment, Inquiry discipline.
- They keep records of the office orders a, circulars and all disciplinary proceeding against employees as well as they provide data and information and give support to the deputy manager's annual Budget and annual implementing plat of the department. They also keep an eye on the financial activities.
- His qualification will be Graduate in Engineering/ MBA/Masters in any discipline any Government University. Age shall be maximum 30 years.

1.5.5. Assistant manager (Estate &Legal affairs):

- He is under controlled by deputy manager. To help in coordinating the legal advisors and lawyers on issue related to legal matters.
- They provide support in any implementation and service security to deputy manager in the development the company as well as they arrange the payments of rents, holding and other taxes for office establishment, permanent installation and oversee financial authority as per approved financial procedure.
- His qualification will be Graduate in Engineering/ MBA/Masters in any discipline any Government University. Age shall be maximum 30 years.

1.6. Commercial Operation

In this section we will discuss DESCO's commercial operations. On May 4 and May 5, these two days we went to Pallabi S&D Division, Mirpur to understand commercial operation. In there, Engr. Raihan Arefin, Deputy Manager (Pallabi S&D Division, DESCO) explained the basic operations of S&D, one point service center and E-governance. The other office stuffs explained briefly about every section. From those explanations, we realized that there are five separated section to run DESCO's commercial operation. These sections handle different types of operation. The sections are:

- One point service center
- S&D
- Change energy meter
- New connection
- IT
- E- governance
- Billing/Connection

1.6.1. One point service center:

We visited the one point service center at DESCO's Kafrul and Pallabi division. From here, consumers get the reliable service, support, information, question's answer, query, and guideline. These one point service centers run by outsourcing, that means the employers are not government employees. So, if they do any kind of illegal operation, DESCO have right to sack them immediately. That why they do their best to survive in DESCO.

Services of one point service center are:

- Receive all kind of consumer complain (Billing and collection related problems)
- Try to solve problems immediately
- If not, complains are registered
- Provide best guideline(New connection/ reconnection/ disconnection)
- Provide any information that the consumer wants
- Records consumer complains
- Load extension
- Load relocation

1.6.2. E- governance:

E-governance means electronic governance. This is online base software, which is developed by BUET (Bangladesh University of Engineering and Technology). All kind of information is stored with this online communication base software system. Every S&D has a server, where information is stored (like application for new connection\ reconnection\disconnection, new energy meter, energy meter change application and billing-collection information, number of meter/consumer, consumer complains, etc). And all servers are connected with a main server or central storage via online. So, data is liquid here.

1.6.3. S&D center:

S&D means sells and distribution. DESCO has nine running S&D center and three S&D are under construction-

Dakshin Khan S & D Division, Mollah Para, Dakshin Khan, Dhaka-1230

Tongi (East) S & D Division,Squib Road, Cherag Ali, Tongi, Gazipur

Tongi (West) S & D Division,Squib Road, Cherag Ali, Tongi, Gazipur

When a consumer applies for new connection or reconnection, new meter or meter change, new or replaces service wire in one point service center, that application is forwarded to S&D center. The S&D create a demand note on consumer requirements. After consumer payment, S&D division provide the services to consumer.

The major activity of S&D is selling like:

- Energy meter
- Service wire
- Pole
- Transformer
- Power factor correction (PFC) bank

Other activities are:

- Energy meter testing
- Distribution transformer repair

1.6.4. New connection:

For new connection, consumer goes to the one point service center. Consumers fill up the form with necessary information (type of connection, distance from distribution pole, and important document about land). After processing all papers and steps, S&D division send an investigation team to there, where the new connection will be constructed. Then the team makes reports on that site. Then S&D division issue a demand note for consumer. At end consumer pay the demand charge at S&D division. S&D division make a schedule for new connection.

1.6.5. Billing/Connection:

Billing/collection activities go under IT section. Meter reader submit meter reading book to divisional S&D division. The IT section collect data from meter reading book and put those data in e-governance software. That software is very smart, it stores data in server and create bill according to the tariff charge. Those bills are printed by a special printing machine. Then those printed bills are distributed to DESCO's consumer (home to home). When consumers pay bills by mobile, online or bank, one part of that bill goes back to respective area of DESCO office, this is called collection. That data also store in e- governance. That software calculates monthly revenue.

1.6.6. Change energy meter:

When a meter reader takes meter reading, he/she also check that the meter is working perfectly or not. If the meter is not working perfectly, the meter reader informs that in complain room. The complain room sends a troop to investigate the site. If the damage occurs by electrical fault, consumer can buy a new meter or rent from DESCO to replace

with faulty meter. If consumer purchase new energy meter from shop, that meter has to test from DESCO test lab. If the report is 'OK' after testing, then the faulty meter is replaced with the new meter without service charge.

Sometimes meter reader finds that the meters are damaged or defective by consumer. In this case, consumer has to pay high penalty like money or permanent disconnection

1.6.7. IT section:

On 5 May, 2011, we visited the IT section at Pallabi S&D division. At there we met with Engineer Habibul Hasan Chowdhury, Assistant Manager (IT section, Pallabi S&D, Mirpur), he explained IT section's operations.

IT section controls e-governance software, billing & collection activity, make monthly expense list, calculate monthly revenue, data entry, online communication system, consumer's info (name & address, type of connection, bill payment information) etc.

Chapter 2

2. GRID AND SUBSTATION

Grid and substation both are the two important parts for supplying electricity. The word substation comes from the days before the distribution system became a grid. The first substations were connected to only one power station, where the generators were housed, and were subsidiaries of that power station.

Actually a substation is a process of step-up transformer or step-down transformer which increases the voltage as decreasing the current, at the same time as a step-down transformer decreases the voltage then it will increase the current for domestic and commercial distribution.

A Grid means a large installation power lines or underground cables are switched and where electricity is transformed to the distribution to surrounding areas. Each substation can be a hundred meters or more across and is surrounded by a metal fence. Now in the following discussion we are going to learn about the grid and substation operation and different types of grid and substation.

2.1. Grid and substation operation:

We saw a grid transformer in Kafrul (at Mirpur). An electrical grid transformer is two or more interconnected large network which can deliver the electricity from suppliers to consumers. It consists of three main components a large:

1) Generating that produce electricity from combustible fuels (coal, natural gas, biomass) or non-combustible fuels (wind, solar, nuclear, hydro power);

2) Transmission lines that carry electricity from power plants to demand centers; and

3) Transformers that reduce voltage so distribution lines carry power for final delivery

In Bangladesh the total generation of electricity is 17.89KV.In Bangladesh the voltage transmission are 132KV, 230KV, 400KV respectively. But in the grid at DESCO the step down transmission is 132KV to 33KV.

In DESCO there are three grids: Bashundhara grid, Uttara grid, and Digun grid. Among these three grids I had got opportunity to visit on Digun grid which is on Mirpur and where 132/33KV transmission operates.

2.2. Grid transformer:

In the power industry, electrical grid transformer is a term used for an electricity network which includes the following three distinct operations:

1. Electricity generation – Here we observed at DESCO the generating plants are usually located near a source of water, and away from heavily populated areas. (Like Mirpur DOHS) They are usually quite large in order to take advantage of the economies of scale. The electric power which is generated is stepped up to a higher voltage-at which it connects to the transmission network.
2. Electric power transmission – Here the transmission network will move the power long distances-often across state lines, and sometimes across international boundaries until it reaches its wholesale customer
3. Electricity distribution – In a substation at DESCO, the power will be stepped down in voltage—from a transmission level voltage to a distribution level voltage. As it exits the substation, it enters the distribution wiring. Finally, the power is stepped down again from the distribution voltage to the required service voltage.

2.2.1. Oil type transformer components:

We observed our working period that some important components which are used in Kafrul transformer. Actually oil is used in OCB. It is inflammable. So oil will be decomposed but it is not compressed.

Now we are going to discuss some important components of oil type transformer

Tank and tank cover:

The tank Cover is a flat rein-forced with ribs, or where the tank and the tank cover are welded construction. We saw at DESCO that this type of adjusted for the road transportation on special vehicles where it is placed on a wagon

Primary and secondary windings

Primary and secondary windings are so important for oil type transformer. Now the primary and secondary winding are as follows the primary circuit is the low voltage side. It includes:

- power source from the battery
- in some instances, ballast resistor
- primary windings connecting to:
  - contact breaker points
  - condenser
  - The earth thus completing an electrical circuit.

The secondary circuit is the high voltage side. It includes:

- secondary windings connected to coil tower output terminal
- high tension lead to center terminal of the distributor cap
- makes an electrical circuit to the rotor
- aligns with each terminal output post
- high tension leads connecting to the spark plug

The brief discussions of these components are given below:

Coolers:

We have learned at DESCO that Cooling is accomplished simply by circulating air around and through the coil and core assembly, either by natural convection or by forced air flow from fans. This cooling method is usually limited to low-voltage indoor transformers (5 kV and below) having a three-phase rating below 1500 KVA. At higher

voltages. oil is required to insulate the windings, which prevents the use of air for cooling the core and coils directly. Here we saw at DESCO that they use four coolers in transformer. But at a time two cooling fans are running and two are stopped .The main reason is the two cooling fan are enough for cooling the transformer now the advantages and disadvantages of oil type transformers are as follows

Advantages:

1. Frequent maintenance is not needed
2. It will not be spoilt easily

Disadvantages

1. This is so big that's why maintenance is a great problem installation is also a big problem.

2.3. Substation:

During our internship period we had got some ideas about substation. Actually substation means a set of equipment that reducing the high voltage of electrical power transmission and make suitable for supply to consumers. Here the terminals connect to transformers that transform the voltage from high to low. Now the substation which we saw in our working period is as following.

Figure 2.3.1: Kafrul substation (33 KV\11 KV).

2.4. Substation activities:

We saw at DESO that the electricity arrives at the substation via transmission lines which are fed into terminals. Initially the electricity at this point is high voltage. Input voltage from the transmission system is generally 230 kV. The terminals connect to the step down transformers that transform the voltage from high to low. We saw at DESCO that it transform 33KV to 11 KV. In DESCO the distribution of electricity leaves the substation via overhead or underground feeders which run along streets and eventually power the distribution level transformers at or near the customers' premises. Now their ongoing planning are given below,

- Installation of 33/11 KV substation.
- 33kV network planning for 33/11KV substation.
- 11kv underground line for feeders and switching station
- Every substation has been proposed for two main sources from one grid and standby sources from another grid.
- Overhead source lines will be replaced by underground line.
- Provision for future new substation
- Alternative sources for substation

2.4.1. Circuit breaker:

We have some ideas about circuit breaker that when we are working at DESCO'S substation and grid like Mirpur DOHS, Pollobi and Kafrul. Actually a circuit breaker is a switch that automatically interrupts electrical flow in a circuit in case of an overload or short. By sensing and responding to conditions where the normal load current is exceeded, which is called over current, circuit breakers help to protect our home and family from electric shock and fire. Here DESCO uses those circuit breakers which have common features in their operation, although details vary substantially depending on the voltage class, current rating and type of the circuit breaker. We sharply observed at DESCO that the circuit breaker must detect a fault condition; in low-voltage circuit

breakers this is usually done within the breaker enclosure. According to the voltage level circuit breaker are divided in three types.

- Low voltage<11KV

  MCB (Miniature circuit breaker)

  MCCB (Molded circuit breaker)

- Medium voltage(up to 33KV)

  BOCB (Bulk oil circuit breaker)

  MOCB (Minimum oil circuit breaker)

- High voltage circuit breaker(High voltage>33KV)

  SF_6 circuit breaker

  ABCB (Air blast circuit breaker)

The figure of a circuit breaker which we had seen at DESCO is as follows.

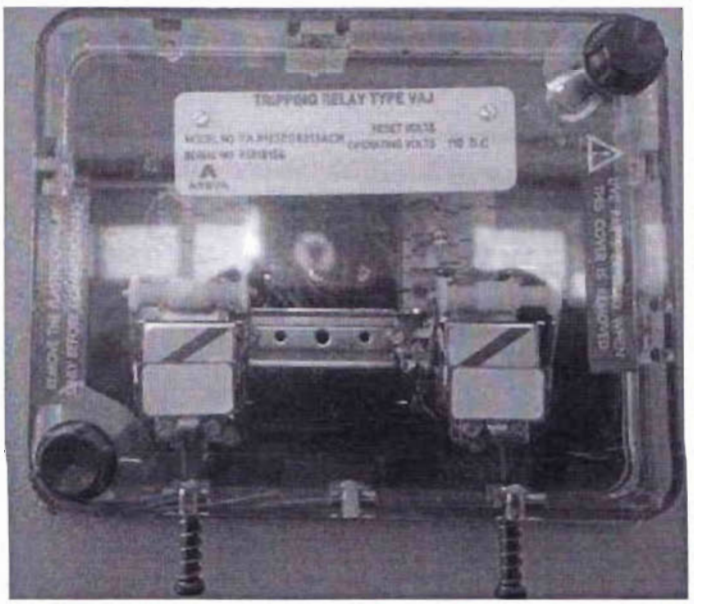

Figure 2.4.1: 11 KV MOCB type circuit breaker

2.4.2. SF_6 circuit breaker:

During our Internship period we have visited Mirpur DOSH grid. Here the grid uses sulpher hexafluoride (SF_6) is a high voltage circuit breaker. A SF6 circuit breaker contains a pressurized container of Sulfur Hexafluoride gas (hence SF6) which is blown onto the contacts on the instant of opening to 'blow out' the arc. Actually SF_6 is an inert gas. Here pressure is directly proportional to the dielectric strength. In DESCO we saw that SF_6 has 50 KHz frequency. Here the system is for 230KV. In this breaker the temperature is up to 3000K Frequent maintenance is needed for that circuit breaker. Here DESCO also use a mechanical alarm to indicate the pressure decrease. In this circuit breaker ions are not decomposed that's why it absorbs the ion and it behaves like a negative ion. Actually SF_6 is suitable for outdoor application. Moreover it is not harmful for our health

2.4.3. Vacuum circuit breaker:

Vacuum circuit breaker is not available in DESCO. Because they use SF6 circuit breaker A vacuum circuit breaker has a vacuum between the contacts in a sealed 'bottle', and because there is no air to sustain an arc on contact opening, the arc is extinguished immediately. VCB is for medium voltage. Not for high and low .Here pressure is directly proportional to the boiling point. Here the dielectric strength and the pressure will be infinite. In thermodynamics low we know that when it is heated then the circuit breaker is opened. This is not for high voltage but it is suitable for high current .The current is up to 3000A. And the voltage is up to 35000V. Here mechanical blowout will not happen but magnetic blow will be happened.

2.4.4. Difference between Vacuum circuit breaker and SF6 circuit breaker

A vacuum circuit breaker has a vacuum between the contacts in a sealed 'bottle', and because there is no air to sustain an arc on contact opening, the arc is extinguished immediately.

A SF6 circuit breaker contains a pressurized container of Sulfur Hexafluoride gas (hence SF6) which is blown onto the contacts on the instant of opening to 'blow out' the arc.

2.4.5. Why DESCO use SF6 circuit breaker

In this section, SF6 and Vacuum circuit breakers are compared considering different factors. Like consider dielectric strength and environment effect. According to the dielectric strength, SF6 has better behavior than vacuum circuit breaker. That's why SF6 generalized both as insulating and quenching medium. The use of Sf6 Makes possible to reduce the size of electric strength and so required for installation. Eventually we observed that dielectric strength is much better and it is so Environment friendly. That's DESCO use SF6 Circuit breaker.

2.4.6. Advantages and Disadvantages of SF6 and Vacuum Circuit breaker

There are some advantages and disadvantages of SF6 and vacuum circuit breaker. Those are as follows

Table 2.4.1: Advantages and disadvantages between SF6 and vacuum circuit breaker.

Criteria vacuum circuit breaker	SF6 circuit breaker	Vacuum circuit breaker
Operating energy	Operating energy requirement is high because the mechanism must supply the energy needed to compress the gas. DESCO uses it because energy requirement is high	Operating energy is low That's why DESCO is not interested to use it as well

Criteria vacuum circuit breaker	SF6 circuit breaker	Vacuum circuit breaker
Arc energy	Arc energy is low because of high energy arc voltage is between 150 to 200v	Arc energy is higher than SF6 circuit breaker. That's why DESCO does not use it.
Cost	SF6 is costly than Vacuum	Vacuum is cheaper than SF6
Switching of transformer	Well suited. Step to be taken more than>600 A. That's why DESCO use it	Well suited. Step to be taken less than<600 A
Switching of capacities	Cover maximum captains	Cover minimum capacities
Voltage	High voltage	High and medium voltage
Short circuit	This principal is not used for short circuit	This principle has advantages when the short circuit current is in excess of 31.5 KA.

2.5. Control relay panel:

Control relay panel is one of the important things in sub-station operation. Actually control and relay panel means we understand an electrical device consisting of a flat insulated surface that contains switches and dials and meters for controlling other electrical devices. A relay is an electrically operated switch. These relays are used where it is necessary to control a circuit by a low-power signal or where several circuits must be controlled by one signal. Control panel relay is completed to an electrical isolation between control and controlled circuits. it is mainly used in power station, switching substation.

These relays are also operated to protect the electric circuit from overload or faults. That's why in modern electric power system it is also called as "Protective relay".

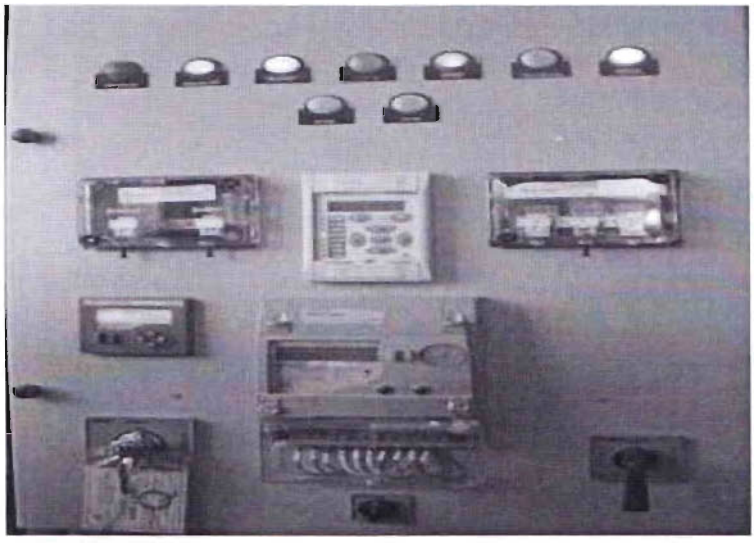

Figure 2.5.1: 33 KV control relay panel.

2.6. Protection relay:

We understand that a protection relay is a device that receives inputs, compares them to set points, and provides outputs. Here Inputs can be current, voltage, resistance, or temperature. Outputs can include visual feedback in the form of indicator lights and an alphanumeric display, communications, control warnings, alarms, and turning power off and on. On the other hand, we can say that a protective relay is a complex electromechanical apparatus, often with more than one coil, designed to calculate operating conditions on an electrical circuit and trip circuit breakers when a fault is detected. The protection relay panel is as follows

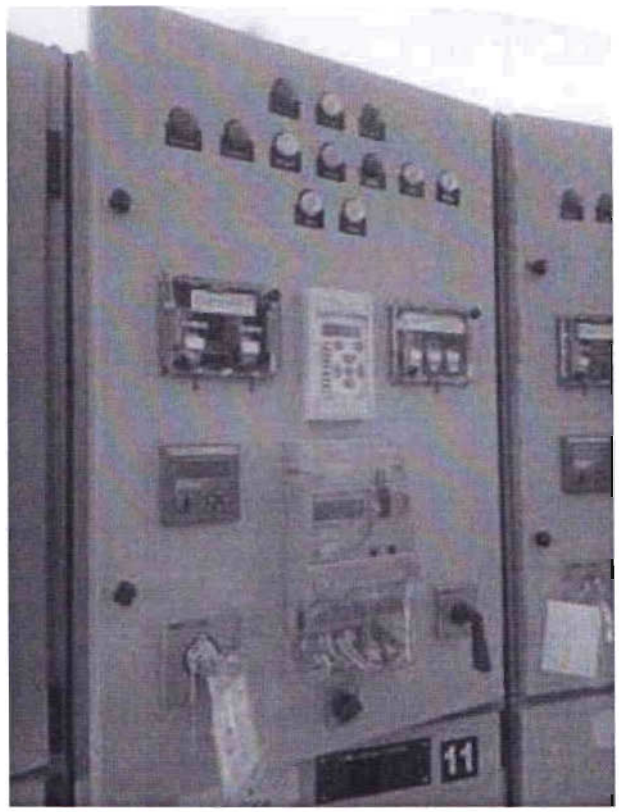

Figure 2.6.1: 11 KV protection relay panel.

The light of the above discussion it is needless to speak the importance of grid and substation. Undoubtedly it plays an important role in distribution system. No country or no nation cannot think their distribution system without these two important factors. That's why not only DESCO, but also the whole Bangladeshis should take some initiative to improve the grid and substation to enlighten our future.

Chapter 3

3. TECHNICAL OPERATIONS

In this chapter we will discuss the major part in our internship program. Here we will go to discuss technical aspect, which we learnt from our internship program. During technical activities, we met many engineers, office stuff, and troop. Everybody was so kind and nice. They answered our question politely.

Technical operations run by S&D division. Now a list is shown about technical operations.

- Line maintenance
- Power factor monitoring and upgrading
- Disconnection and reconnection
- Faulty transformer detection and repairing
- Energy meter testing
- New transformer installation
- Transformer maintenance

3.1. Line maintenance:

Line maintenance is an important part of the operation and management of transmission lines and substations. Maintenance may include clearing the access roads, replacement and construct new poles and towers of transmission lines. On May 10, 2011, we visited a working site near Kazipare, Mirpur. Engr. Tanvir Ahmed, Assistant Manager (Kafrul S&D division) was with us. He explained about the work and planning. At that site two poles were positioning for new distribution transformer and we watched the whole operation.

Figure 3.1.1: Line maintenance activity

Line maintenance is one of the most risky tasks in DESCO. Through transmission lines, thousand volts and ampere flows. So any kind of mistake or wrong step can take the worker life, and also damage equipments. To do best line maintenance, DESCO's engineers follow the following steps:

1. Planning

   Type of work
   - New line construction
   - Replacement pole or line

2. Where is it taking place?
   - Residential Areas
   - Commercial/ industrial area
   - Road Crossings
3. Construction Activities

4. Reporting

Planning: First the responsible engineer creates a plan about the type of work. If it is a new line construction for HT (high tension) consumer, DESCO's workers construct only the feeder line. Engineers follow a common design to construct feeder line. To construct new feeder line, first the poles have to set on ground. To set poles on ground, 6ft deep,

1.5 ft radial holes are made in ground. To set the pole, the pole needs to set in vertical position. This task is done by crane or chain lever and man power. The feeder poles have to 40-45 ft height from ground, and 80-90 ft apart from each other. After positioning all poles, the power lines are constructed. At last the feeder line is connected to step down transformer. For HT consumers, the consumer bears the step down transformer's cost. The worker just connects feeder line with that transformer (if need, power factor plant also installed). If pole has to replace, S&D division makes a schedule and they inform the working site.

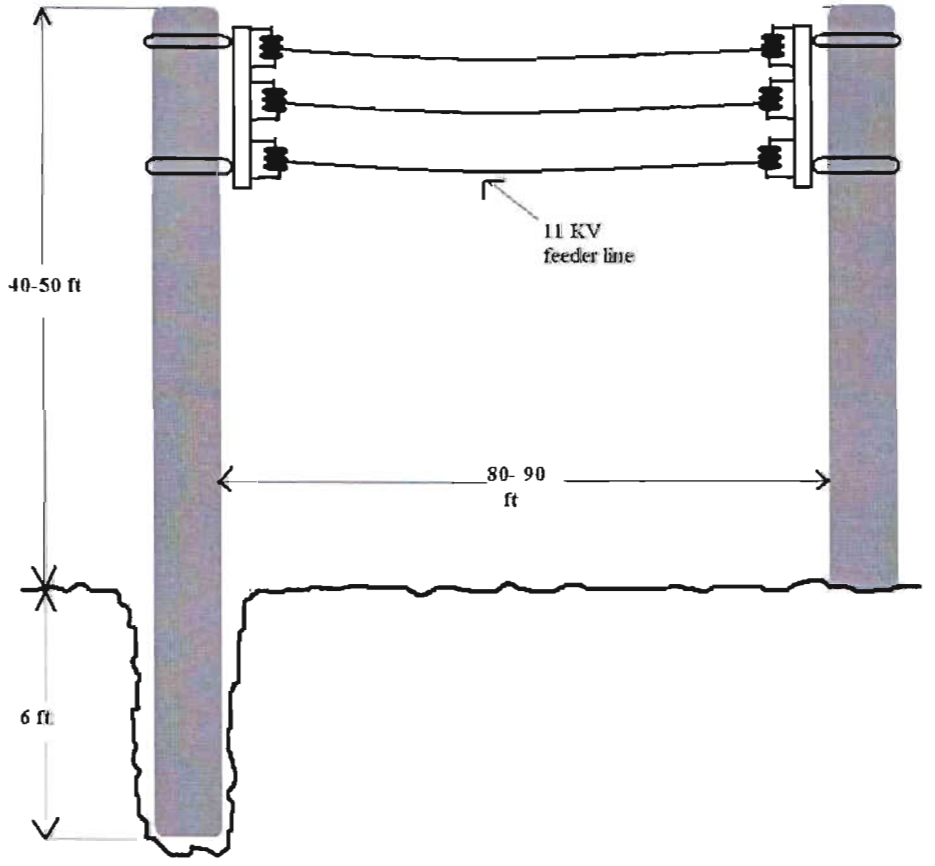

Figure 3.1.2: Design for feeder line pole.

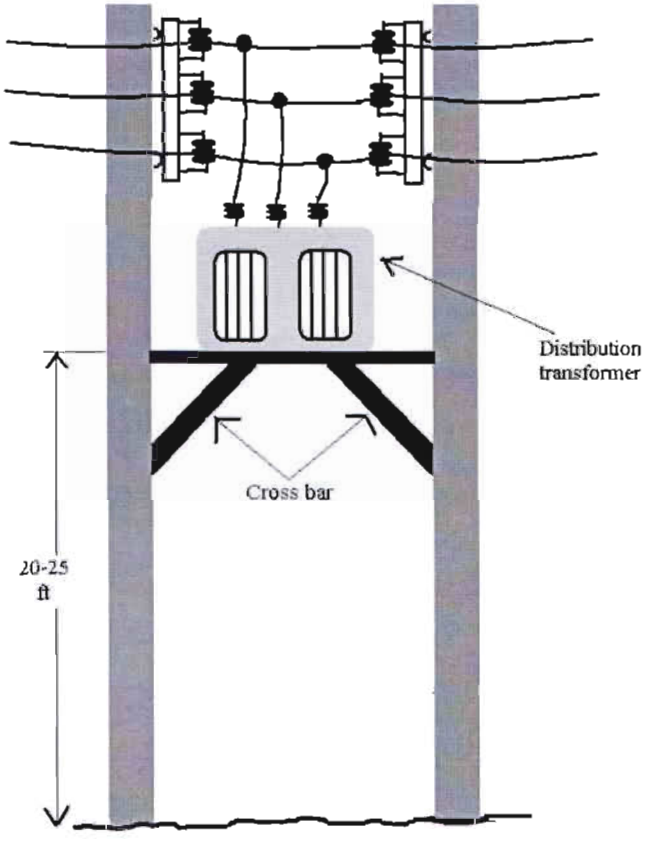

Figure 3.1.3: Design for distribution transformer pole.

Construction near residential areas requires special precautions. For residential Areas, responsible engineers calculate load sanction. Then they design the feeder line pole, transformer pole, distribution line pole. First, the feeder line poles are positioned, then the transformer pole, then distribution pole. The transformer poles are same as feeder line pole. But two poles are placed 6ft apart from each other. Then two cross bar set on that two pole, where the distribution transformers are sited. The cross bars give extra strength.

Everything is same as feeder pole to positioning distribution electric line pole except height and horizontal distances of poles. Distribution current poles height is 20-25 ft from ground; horizontal distance is 50-60 ft from each other.

For road crossing, the pole height has to be above 50ft because of heavy vehicle. These types of line maintenance must be taken at night. Because, sometimes the road need to blocked for maintenance. Before start working, DESCO inform Dhaka City Corporation and police.

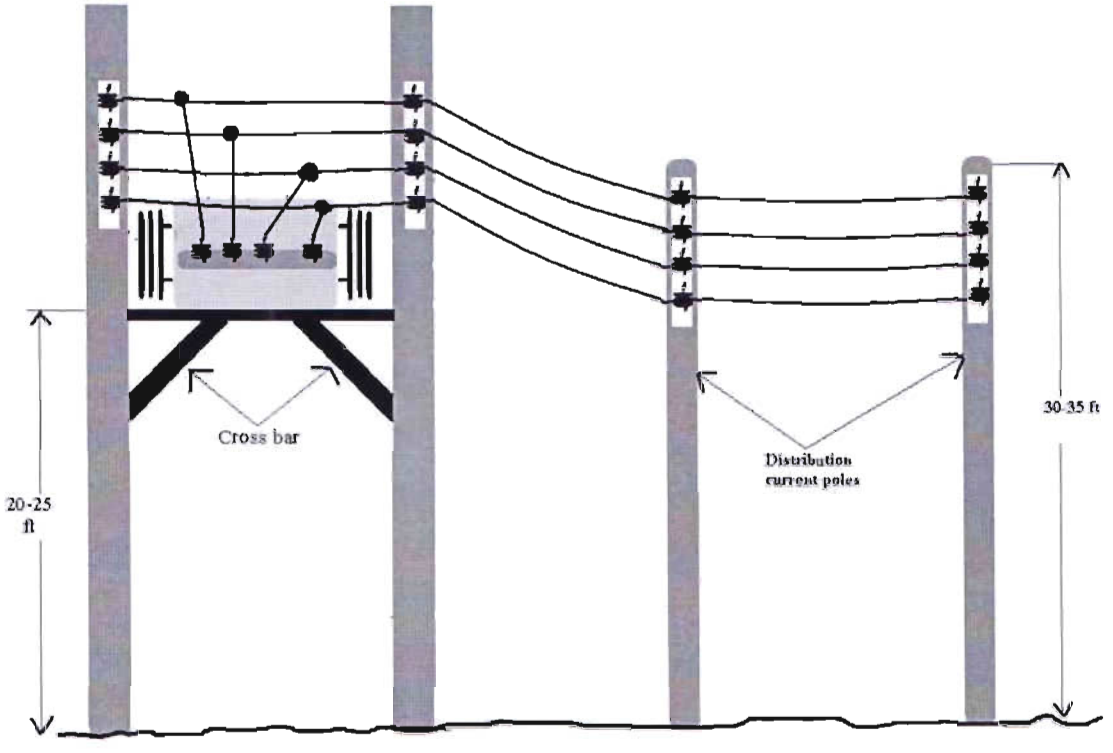

Figure 3.1.4: Design for distribution current pole.

Construction Activities: DESCO's S&D division must give notice to the consumer within 48 hours before start construction. Construction near residential areas and road crossing requires special precautions. During construction responsible engineer must visits the site. The line maintenance troops must follow safety precautions:

- Shutdown source line from control room
- Disconnect transformer breaker
- Discharge source line and transformer
- Use safety shoes, belt, helmet

The line maintenance troop has constant wireless communication with control room to ensure that everything is safe and ok.

Reporting: This is the most important task after line maintenance. Record keeping is a simple, easily implemented, and cost-effective management tool. Every single part has to account. What type of task they did, how many poles are placed or replaced, type of pole, type of wire and how long, about transformer, breaker type, if any change in design and where it is, which troop worked etc. DESCO creates a folder about all this information. Some simple techniques used to record accurate document and report results include:

- Field notebooks
- Timed and dated
- Drawings and maps
- Computer spreadsheets

3.2. Power factor monitoring and upgrading:

Power factor monitoring is the most important factor in power system, because poor power factor imposes negative effects on power generation. We went to Kafrul substation on May 17, 2011, met there with Engr. MD. Rafiqul Alam, Junior Assistant Manager (Kafrul control room), and asked him about power factor and how it can be improved.

Power factor is defined as ratio of real and apparent power. Real power is measured in watts and function of dissipative elements. Apparent power is measure in VA and function of total impedance.

$$PF = \frac{\text{Real power, (KW)}}{\text{Apparent power, (KVA)}} = \cos\theta$$

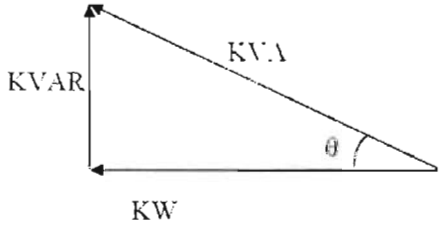

Figure 3.2.1: Vector diagram of power

Here another power affects on power factor, which is known as reactive power, measured in KVAR and function of reactive elements. Actually, power factor depend on this KVAR. Power factor is a unit-less measurement. Power factor measures how efficiently the current is being converted into real power. Or we can say that; the measure of electrical efficiency is known as Power Factor.

3.2.1. How power factor vary:

So from above discussion, we know that power factor is defined as the ratio of KW to KVA. But we see that the cause of low power factor is large KVAR. And we know that magnitude of KVAR is proportional to inductive load. All big factories, industries, workshops are main sources of inductive loads. Inductive load includes:

- Transformer
- Induction motor
- Energy saving light.

Reactive power increases the amount of apparent power. This increase of reactive power and apparent power creates large angle (θ) between KW and KVA. And larger angle produces poor power factor, because PF= cos (θ).

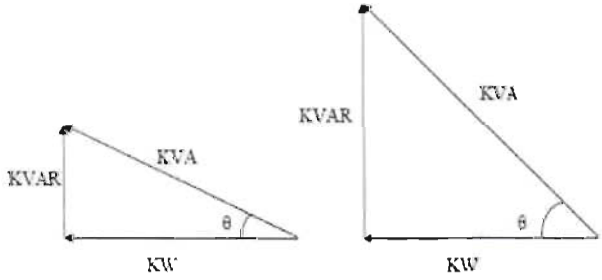

Figure 3.2.2: PF depend on the amplitude of KVAR.

So, we see that, if KVAR would be very small-

- Power factor would be approaching unity.
- KW and KVA would be almost equal

3.2.2. Negative effect of low power factor:

We know PF= cos (θ), for this equation; power factor is usually given as a number from 0 to 1. Higher the PF number, the system is more efficient. But, in real condition, the power factor never meets the unity. For that in power system, PF value from 0.98 to 0.95 regard as a best state. But what happens if PF is below 0.95? The negative effects for low PF are:

1. Poor power factor affects the power distribution system. Power loss in distribution network, voltage drop in feeder line. Excessive voltage drop may cause over heating in distribution network.
2. Poor power factor affect the generation plant. Because most of the power generators are also induction machine. The reactive power comes from these power generators. Poor power factor means more reactive power. More reactive power overloads the generators.

Another thing is electric billing, poor power factor make power loss in system

3.2.3. How DESCO improve power factor:

DESCO is very much concern about maintenance of good power factor. Because, poor power factor creates power loss in distribution system. If the average power factor gets down below 0.95, DESCO pay system loss charge to LNDC. This is a rule to minimize system loss.

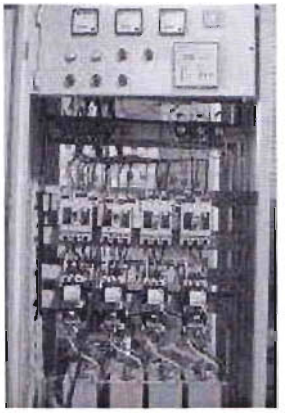

Figure 3.2.3: Substation PFC plant.

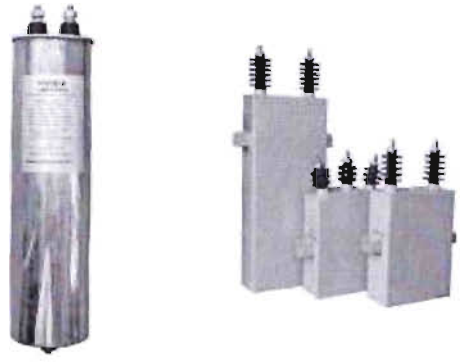

Figure 3.2.4: Power capacitor.

So every DESCO's substation has power factor correction (PFC) plant to control power factor. For further protection, in residential area, power factor correction banks are installed on poles. This PFC plants or banks are made of big capacitors, which are called power capacitor. Pole mounted PFC bank is not expensive and the LT consumers do not bear this cost. But for HT consumer like industry/ factory/ heavy workshop, the HT consumers install PFC bank by their own expense. And DESCO's metering-billing sections monitor that the PFC plant work properly. So that, the HT consumer use different type of energy meter which monitor power factor, and they have to pay power factor charge. For HT consumer, electric bill is different than LT bill.

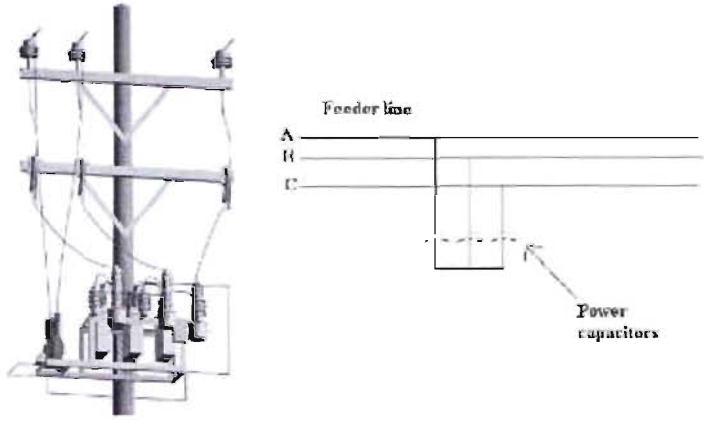

Figure 3.2.5: Pole mounted PFC bank.

3.2.4. Basic operation principle of PFC plant/ bank:

Mostly the PFC plant/ bank made by power capacitor. We know that; for inductive load; current leads over voltage and for capacitor load; voltage leads over current. So the PFC plant/ bank just oppose the inductive load effect. In figure 5.1.10, we see that the magnitude of reactive power is decreasing for adding PFC plant/ bank. $\theta 1 > \theta 2$, and magnitude of KVA2 is almost equal to the magnitude of KW.

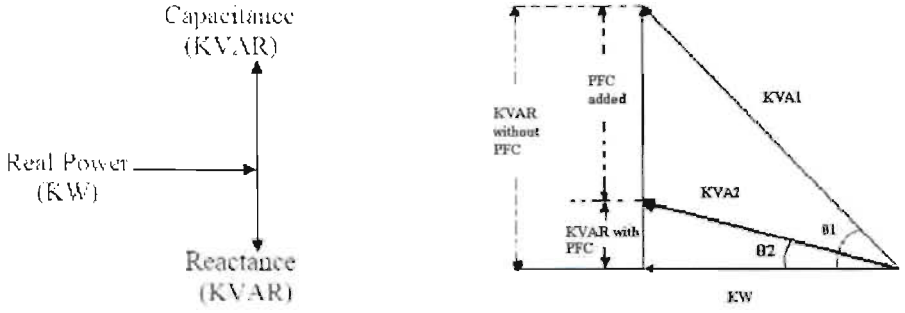

Figure 3.2.6: The effect of PFC plant/bank on PFC

3.3. Disconnection and reconnection:

On May 4, 2011, we joined with Engr. Raihan Arefin, Deputy Manager (Pallabi S&D Division, DESCO) to watch disconnection and reconnection activities. To do this, DESCO use a team whose are expert to do disconnection and reconnection activities.

Figure 3.3.1: Disconnection activity.

Normally the illegal power connections find in slum area, road side small and floating shops. They have also a chart about consumers, for long term unpaid bill. DESCO disconnect consumer's line for four main reasons:

- For non-payment electric bill (bill dues more than three month)
- For illegal electricity connection (service line without meter or DESCO permission)
- For electric safety/security (Service line has loss or burn)
- For consumer demand. (Consumer consume more power than he/she demanded before)

If then the consumer paid all dues or complete all official formalities then the consumer get reconnection.

3.4. Faulty transformer detection and repairing:

In DESCO territory, large numbers of distribution transformers are used to distribute power. From 'DESCO annual report-2010', the number of the distribution transformers is 4810. For extension distribution network, DESCO use new transformer. To minimize the cost, DESCO's S&D division also repair faulty distribution transformer. In every month, almost 50 to 60 transformers burn in DESCO territory in summer. The lowest price of a distribution transformer is 3, 00,000.00 taka.

On May 9, 2011, we visited the transformer repairing section with Engr. Tanvir Ahmed, Assistant Manager (Kafrul S&D division). He said that common faults of transformer are:

- Transformer coil burn
- Drop off fuse
- Low dielectric strength in transformer oil

3.4.1. Transformer coil burn:

Coil burn is very common in distribution transformer. It happens when distribution transformer runs under overload for long days. To detect transformer fault, at first the 'insulation tester' is used. This insulation tester is used to measure the resistance of

transformer insulation. This tester has a prime mover, mega Ω meter, and two probes. To test the transformer insulation, one probe is connected to high side and another to low side. Then the prime mover is revolving by 120 rpm (rotating per minute), that tester produce almost 1000V across the probes, but very low current flow. If the meter shows the resistive value less than 5 MΩ, it means coil is burned, otherwise the tester shows more or equal to 30 MΩ.

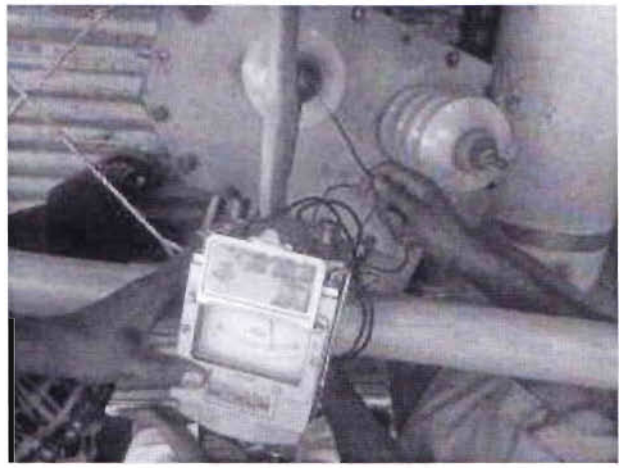

Figure 3.4.1: Distribution transformer activity with coil test insulation tester.

If the transformer is burned, the coil is rewind as like as before. First the burned coil is replaced with good coil. After coil winding, insulation tape is rolled over the coil to protect from rust.

Figure 3.4.2: Rewinding transformer coil

Then that new winding core placed in heat chamber. In this chamber, the temperature is about 300°C. The new core is placed in there for two days to remove moisture. Then the new core is installed in transformer container.

Figure 3.4.3: Heating chamber

3.4.2. Drop off fuse burn:

Drop off fuse is a protection to avoid transformer burn. Drop off fuse burn when transformer's distribution or feeder lines fall in short circuit fault or ground fault. A new drop of fuse is placed to solve this problem.

Figure 3.4.4: Transformer dope off fuse.

3.4.3. Low dielectric strength in transformer oil:

One kind of oil is used in transformer to isolate coil-container and cooling the transformer. This oil is a dielectric material. If the oil dielectric value decreases, the core can be burned or a serious accident could be occurred.

So, DESCO check the oil dielectric strength every two or three years since the transformer is installed. The line maintenance team takes oil sample from distribution transformer, send it to DESCO lab. If the dielectric strength is low, DESCO use a machine, name 'Centrifugal machine' which refine oil. After refine, the oil dielectric value is recovered and the oil can be reused.

3.5. Energy meter test lab:

In every S&D division, there is an energy meter test lab. Before use a meter, that meter have to be tasted from test lab. If consumers purchase energy meter from market or DESCO, it has to be tasted. We visited energy meter test lab at Mirpur old S&D division, Pallabi on 5 May, 2011. Shahenewaz Begum showed us the meter test lab; she explained the system to test a meter.

To test a meter, that meter is connected to a digital meter tester. That meter tester act as load and create a true pulse for single unit power consumption. A fixed amount of power flows through meter. A sensor is placed in front of the meter. That sensor is connected to meter tester. That sensor receives pulse from the meter and sends it to the meter tester. The meter tester compares difference between the true pulse times with sensor pulse times. The time difference is the meter error, and the error is calculated in percentage. The difference could be negative or positive. If the error is less or equal to ± 1%, the meter get pass from lab.

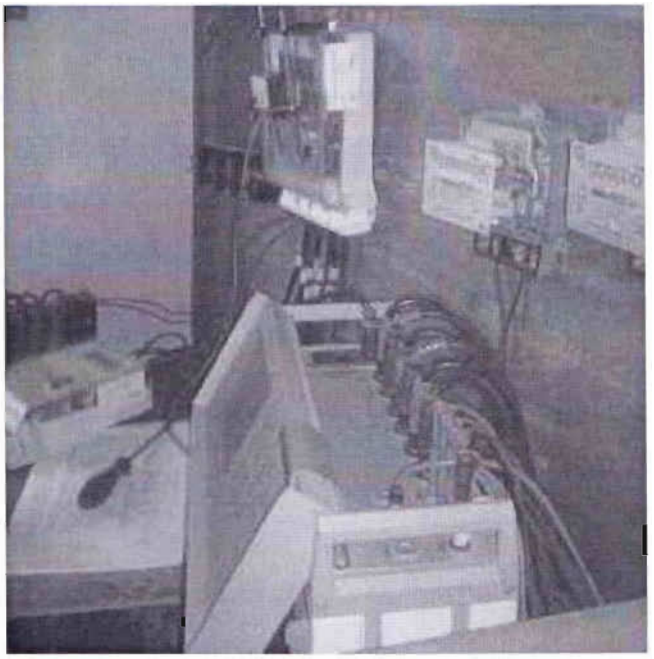

Figure 3.5.1: Meter test lab.

Chapter: 4

4. TRANSFORMER OPERATOPN

Transformers are also important to transfer electric energy from one circuit to another circuit. Actually transformer means in such type of device that transfers electrical energy from one circuit to another through inductively coupled conductors to the transformer's coils. In the following discussion we are going to learn about the transformer, their principal, new transformer installation, load estimation load sanctioning, their maintenance, testing the transformer and insulating oil test etc

4.1. Transformer

A transformer is a static (or stationary) piece of apparatus by means of which electric power is one circuit is transformed into electric power of same frequency in another circuit.

Transfer Principal:

- There are two electric circuits which are called 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 timing varying magnetic flux in the core.
- A voltage is induced to the secondary according to the Faraday's Law.

4.1.1. New transformer installation

We had seen new transformer installation at Mirpur DOHS, and Kafrul As the part of policy making, time to time DESCO on its own initiative to install the new transformer because they want to keep in better touch using their coolest initiative. In the base of their planning and distribution system, they follow a number of design parameters like voltage, conductor size and capacity, voltage drop; etc .The new transformer installation work picture is given below.

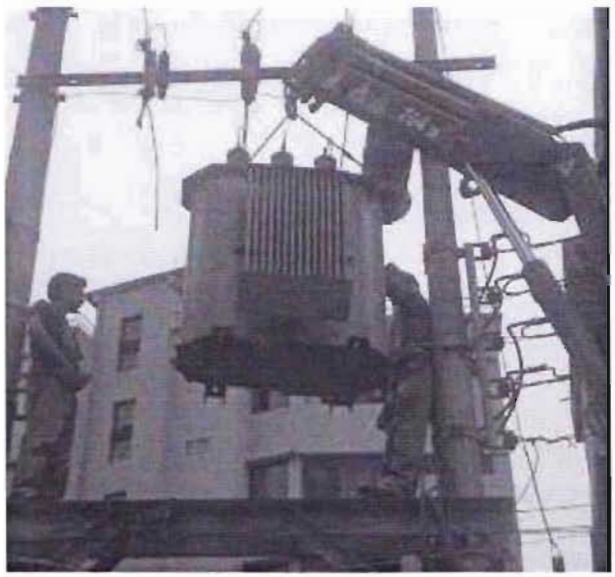

Figure 4.1.1: New transformer installation.

4.1.2. Installed capacity:

Here our internship period we understood that installed capacity is one of the challenging works because in the electricity system every equipments and line has its maximum load handling capacity. Capacity (power) is usually denoted by Volt-Ampere (VA) which is also conversable into watt multiplying power factor with VA. Therefore, the installed capacity of an electricity system indicates the maximum VA or Watt it can handle. In this case of electricity generation, it is summation of the capacities of all power plants within the system. In case of electricity distribution system, usually it is summation of the capacities of the substation where the high voltage is converted into low voltage, the capacity of electricity line and cable are also considered as deriving the capacity of distribution transformer.

Now the design parameters and definite limitations are given below

- To avoid the line construction along the both sides of the road.
- Not enough approval between building and electric line.
- Insufficient space for line construction.
- Appropriate line route are not available.

- DESCO will take some effective step to avoid the transformer installation on each pole .and minimize the number of transformers

In light of above discussion, DESCO will take some following steps:

- Area of building should be floor.
- To ensure the maximum use of load and load sanction from the load point.

Table 4.1.1: Load sanction and load point

Total floor area including Basement, car park and Other common use areas In a building	1200sq. feet or more irrespective of number of floors in the building	Customers shall install his/ her own substation(distribution transformer, PFI plant, etc)
Load point	Assessment of the total load shall be per calculation in article 4	For 50kw load or above, customer install his/her own substation(distribution transformer, PFI plant, etc)

Now the Load determination and evaluation factor are the two major important factors for transformer installation. Two important things are given below:

4.1.3. Load determinants:

Load determinants are one of the most important things for new transformer installation. Now the load determinants are as follows.

- Light load
- Fan load
- Socket outlet
- Lift
- Water pump
- Other electric machines/ equipments/Applications

Now we are going to discuss the load determinants factor

Table 4.1.2: Load determinants factor.

1. Light load:

location Bed room/ drawing room /living room/dressing room/kitchen room	Single point per room		2points per room		More than two points per room		estimated load
	A	100	B	60	C	40	
Corridor/ passage/Toilet/Stair	X		X				X*60
Garage/basement/verandah/ Garden/open yard	Y		60				Y*60

Estimated light load=(A*100)+(B*60)+(C*40)+(X*60)+(Y*60)] Watt

Table 4.1.3: Fan load.

2. Fan load:

Type of fitting/ fixture	No of fan load	watt per point	estimated load	remarks
celing fan/ table fan	A	70	(A*70)	load to be considered actual
Exhaust fan/ predestal fan	B	90	(B*90)	

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

Table 4.1.4: Socket load.

3. Socket load:

		No. of Points	Watt per point	No. of Points	Watt per point	No. of Points	Watt per point	
Bed Room/Drawing Room/Dining Room/Living Room/Dressing Room/ Kitchen Room/Corridor/Passage/Toilet	2-Pin	X	200	Y	150	Z	100	(200 x X) + (150 x Y) + (100 + Z)
	3-Pin	A	1000	B	600	C	400	(10000 x A) + (600 x B) + (400 + C)

Table 4.1.5: Lift load.

4. Lift load:

Passenger capacity		Load		Remarks
	Lift to be installed			
	Lift at site	In case of availability of document	In case of non-availability of document	
1	2	3	4	5
4 persons	as per nameplate rating	As per catalogue/ drawing	5	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 of total load re-sensation thereof
6 persons			8	
Above 6 up to 10 persons			10	
Above 10 persons			15	

Table 4.1.6: Electric equipment/ application load.

5. Electric equipment/ application Load:

Equipment/Application	Standard load	Remarks
1	2	3
Refrigerator	100	Actual loads, already connected to a socket, higher than specified standard shall be considered in estimation of total load
Television	100	
Micro-Weave Oven	1000	
Washing machine	500	
Iron	1000	
Ai conditioner	2000	
Eclectic Geezer	2000	
electric burner/ heater	2000	
water pump	At actual	Based on actual motor rating
Industrial machine/ medical equipment	At actual	Based on actual motor rating
Any other electrical equipment/ Application	At actual	Based on actual motor rating

Total load estimation:

Total Estimated load =1+2+3+4+5

Evaluation Factors:

Actually evaluation means estimate the loads. The consumer will be required to submit upon 1000.00 take for load Estimation. Subsequently DESCO will inform the consumer of the date and time to visit the load re-evaluation. Generally Evaluation will depend on the number of factors as specified below

- Load point location
- Connected load
- Future load provision
- Diversity in use

Protection of transformer

Protection of transformer is one of the challenges for DESCO. That's why they have taken some important steps for transformer protection. Those steps are as follows

- Normal operation
- Prevention of electrical failure
- Mitigation of the effects of electrical failure
- Protective device:

- Switchgear
- Fuse
- Functional characteristics of protective relaying

- Sensitivity, Selectivity and Speed
- Reliability

4.2. Load sanction:

- Here DESCO will review the request from the applicants of the load asked and the total estimated load before sanction. The sanctioned load will no larger than the estimated load.
- Following the chat follow the load sanctioning authority

Table 4.2.1: Estimated load and sanctioning authority

Estimated load	Sanctioning Authority
Below 50kw	Head of S&D Divisions
50-250kw	General manager (E&Sc))
Above 250kw	Director(Technical)

- DESCO will make sue than all the distribution transformer are working properly or not as well as the feeder line RMU,33/11Kv substation .11 KV switching station, grid substation etc.
- If there is any technical problem occurred then DESCO refuse the sanction load.
- Common service load = sanctioned load for the building- Estimated load against individual meters.

4.3. Transformer protection scheme:

Transformer protection scheme is one of the significant works of new transformer installation. There are some problems in transformer. To avoid those problems transformer protection scheme are so important. Now the protection schemes are given below

Main (A&B) Protection:

1. Differential Protection.

2. Restricted Earth Fault Protection. (Both at 275 kv and 132 kv) side neutral of the star winding.

Backup Protection:

1. C.B Fail to trip.
2. I.D.M.T Non Direction O/C & E/F relay on 300 KV side

3. I.D.M.T Direction O/C & E/F relay on 132 KV side
4. Inter Trip (through pilot cable).
5. Buchhols Trip.
6. Tap Changer Buchhols Trip.
7. Oil Temperature Trip.
8. Winding Temperature Trip.
9. Cable oil pressure Low Trip. (for cable tails)
10. SF6 pressure Low Trip.

4.3.1. Transformer fault protection:

There are different types of fault in transformer. Among them external and internal fault are the major faults of those fault. Now the two types of fault are as follows difference of external and internal fault:

Internal fault

During our internship period at DESCO we saw that internal fault is happened for the following reasons

- Winding Phase-Phase,
- Phase-Ground faults
- Over current fault
- Restricted ground fault protection
- Winding inter-turn faults
- Core insulation failure,

External fault

External fault is also happened for following reasons.

- Overloads Thermal
- Over voltage
- External system short-circuits
- Instantaneous over current fault

4.4. Transformer Maintenance:

Maintenance is not just about doing repair and is not just a cost. Maintenance sustains productive capacity. It does not create capacity. But it can used to ensure that capacity is available when needed it. In power system, the operation and maintenance includes performing routine actions which keep the device in working order(known as scheduled maintenance) or prevent trouble from arising (preventive maintenance).

Maintenance of transformer:

- The transformers are static equipment: hence the maintenance requirements are quite different from those of rotating machines. The life of transformer can be extended up to 20 years if proper operation and maintenance are done.
- The transformer should be inspected regularly. Regular inspection, periodic maintenance and annual checks are essential for long trouble free maintenance.
- The transformer may fail due to abnormal operation condition, overloading, aging of installation, deterioration of dielectric strength of oil, pressure of moistening, etc. the failure may occur in winding, tap changer, bushing, etc.
- The quality of oil is important. The requirement is to maintain the insulation. In good condition. Moisture, dirt and excessive heat in contact with oxygen are the main causes of insulation deterioration. In case of oil immersed transformers, if the sustained operating temperature exceeds the normal operating temperature of 60°C, over ambient temperature of 40°C by about 10°C, there will be a shortening of the life of the transformer.
- Periodic maintenance and minor repair works are recommended to achieve trouble-free performance.

4.5. Testing and commissioning (transformer):

We had sharply observed that sometime while installing the transformer here some defects of the transformer parts are given along with the cases. To maintain the part of this transformer it is needed to know what kind of deflects is occurred in those parts. Now there are some types of testing and commissioning are given below

- Virtual check
- Induction resistance measurement
- Vector group test
- Measurement of winding resistance
- Ratio test of bushing CT
- Dielectric test of oil
- Short circuit test
- Oil/winding temperature meter test
- Impedance test

Here we had seen some common defect is noticed in the following tables:

Table 4.5.1: Common defect in transformer.

SI.No	Part	Defects	Causes
1	Tank	a. Leakage of oil b. Deformation c. Overheating	Corrosion/ mechanical damage gaskets worn out excessive internal pressure-improper circulation of cooling oil and ventilation
2	Radiator	a. leakage of oil b. deformation c. Overheating	Corrosion/ mechanical damage gaskets worn out excessive internal pressure-improper circulation of cooling oil and ventilation

3	Conservator	a. Leakage of oil b. Deformation c. Overheating	Corrosion/ mechanical damage gaskets worn out excessive internal pressure-improper circulation of cooling oil and ventilation
4	Breather	Ineffective	Inlet chocked-silica gel saturated
5	Explosion	Glass broken	Mechanical
7	Winding	a. Short circuited b. Loss, c. Insulation Brittle d. Open circuited	Overloading-Air bubbles-loss of insulation-shrinkage displacement-overheating decomposition burn out
8	Oil	a. Discoloration, b. High acidity c. Sludge	Contamination -increased moisture decomposition chemical action with other parts
9	Terminal bushing	a. Breakage b. Leakage of oil	Strain -gasket worn out loose fit
10	Tap switch	a. Inoperative b. burn contact c. Broken lever d. Short circuit	Mal-operation insulation failure of operation mechanism overheating

4.6. Insulating Oil testing

Insulating of oil testing is also the significant work of new transformer installation because if the oil is not pure then the transformer efficiency will hamper. That's why pure oil is one of the much needed conditions of new transformer installation. Now insulating oil testing is given below.

Text/parameter	Reference value
Dielectric strength test: between two	minimum 30KV at 2.5mm gap
	Gloves with minimum mm diameter
Acidity test :	acid value less than 0.02 mg KOH/g
Measurement of moisture Absorption in oil	50-60ppm
Gas analysis:	
Velocity at 20°C:	40 cst
Pour point maximum:	-10°C
Flash point:	140°C
Dissipation factor or Power factor/loss ten delta:	at 90°C 0.5%
	At 20°C 0.1%
Volume resistivity cm:	5.7*10^14Ω-cm
Interfacial tension at 27°C	minimum 0.04N/m
Dielectric constant:	2 to 2.5

In the light of the above discussion, we can say that new transformer installation, and their maintains is a great challenge for DESCO. And at the same time transformers are also the undetached items for proper distribution system. So to improve the transformer and to customize these we need to have some initiative .But DESCO is going to implement this installation for their far reaching thought.

Chapter-05

5. 33KV SUBTRANSMISSION CABLES

33KV substation cables are a process of over current, earth and pilot wire protection cables. Route planning of 33KV substation lines are so important for transmission lines. Because if the 33KV sub transmission line is not satisfactory then transformer will faced some problems. So it is really an important matter to improve the 33KV substation cables. Now some initiative to improve the 33KV substation cables and some protection schemes are as follows.

5.1. Route Planning for underground 33KV cable

It is also the part of policy making to route planning for underground 33KV cables. Underground 33KV cables are mainly used for Grid transformer and substation transformer. We have also seen at Kafrul substation. Now following the route planning is given below:

5.2. 33KV feeder protection schemes:

There are several types of protection are for 33KV feeder protection schemes. Protection schemes are as follows

- Over current (O/C) protection
- Earth fault (E/F) protection
- Pilot wire protection

5.2.1. Working principal of O/C and E/F protection in 33KV feeder:

Now the following number of working principal are given below

- Main relay will get the sense from CT.
- Main relay gives sense to trip coil of the circuit breaker (CB).

- Trip relay send pulse to trip coil of the CB.
- After tripping of CB, main relay will get reset but indication/ flag will persist, this is to be rested locally.
- Trip relay normally resetting by ESC, it can possible locally also but local reset only to be carried out in local mode.

5.3. Route Planning of 33KV SUB-transmission lines:

Route planning of 33KV substation lines are so important for transmission lines. Because if the 33KV sub transmission line is not satisfactory then transformer will faced some problems. To avoid those problems DESCO can take the following steps,

- DESCO has a standard design parameter. It has maximum allowable voltage drop, system loss, use of standard conductors etc.
- Their estimation demand up to 10 years.
- The incoming source is reliable for 33/11KV sub-station.
- Addition of 33KV feeders to the exciting sub-station for sharing the load of over load feeders
- Increase reliability of exciting feeders.
- Here has a dual feeding facility from different source
- The ring between the sub- stations.
- Easy maintenance for the feeder.
- Existing capacity and firm capacity of substation
- To shift the load from over load existing
- Addition and replacement of transformer for increasing S/S capacity

- It depends on load estimation up to next 10 years, location of proposed new S/S, if requires considering load requires available 33 KV source.
- To modify and extend of control room building, equipments foundation, cable, cable trenches etc.

5.3.1. Main consideration for distribution planning:

There are some important things which are consider as the main distribution planning .those are essential for 33 KV substation feeder .Those are as follows

- To cater load demand up to next 5 years.
- To minimize interruption of power supply.
- To create facilities for new consumers.
- To minimize technical loss to acceptable limits.
- To limit voltage drop to the following maximum figures at points from the supply point.

Table 5.3.1: Voltage drop from the supply point.

❖ 33KV system	1%
❖ 11KV system	3%
❖ 400/230 volt system	4%
❖ Service drop	1%

In the light of the above discussion, we can say that route of 33KV cables is a great challenge for DESCO. So to solve that problem we have firmly determined to check it out. Eventually we also say that not only DESCO but also we have to take some necessary steps to overcome this problem. But DESCO is going to implement for 33KV cables their far reaching thought.

Chapter 06

6. OTHER OPERATIONS

In this chapter we will discuss about the operation besides commercial and technical operations. These operations are consumer service oriented like solving consumer's problem and balancing the power system.

6.1. Control room operations:

Control rooms are very important in power system. In DESCO territory, there are eight control rooms. Those control rooms open 7 days, 24 hours. We visited three substations in our internship program. First we visited kafrul substation on May 8, 2011 with Engr. Tanvir Ahmed, Assistant. Manager (Kafrul S&D division), and we met with Engr. MD. Rafiqul Alam, Junior Assistant Manager (Kafrul control room and sudstation). Second, we visited Mirpur old substation and control room, Pallabi on May 12, 2011 with Engr. Shawkat Ali, Assistant Manager (Mirpur old, Pallabi). Third, we visited Mirpur DOHS substation and control room, Section 14, Mirpur with Engr. Imrul Kayes, Senior Engr. (Energypac Engineering LTD) on May 21, 2011. We spent almost 16 hours at these substations. We asked questions, we familiarized with substation equipment, its operations and maintenance. The basic operations of a control room are:

- Communicates with other control rooms or grids
- Communicates with line maintenance teams
- Manage load shed
- Record data (Supply load, demand load, load shedding time)

6.2. Complain Room operations:

On May 10, 2011, we visited the Mirpur complain room (Mirpur S&D division, Kafrul, Dhaka). This section is for receiving consumer's complains. DESCO runs eight complain rooms. Those complain rooms also open 7 days, 24 hours with three shift work

time. We spent 3 hours in that complain room. We also receive the phone and record complains. The most common complains are:

- Distribution transformer out of service (for shot fault, ground fault, breaker trip)
- Distribution transformer has been stolen
- Problems in Source line or distribution line

Complain room operator send a line maintenance team to solve the problem immediately.

6.3. Wireless communication system:

To establish uninterrupted communication among control rooms, among line maintenance teams, control room to line maintenance team, DESCO's control room operators, complain room operators, line maintenance teams use wireless communication module. They use wireless communication module because:

- It is portable
- Uninterrupted communication
- Dedicated frequency
- To avoid misunderstanding.

Chapter 07

7. DESCO'S PROJECTS AND FUTURE PLANS

In this chapter we will discuss about DESCO's ongoing projects and future plans. On 18 May, 2011, we went to DESCO head office, Banani. In there we met with Engr. Zulfiquar Tahmid, Manager (SE & D). He told us about the DESCO's ongoing projects and future plans. We asked him some question and he answered clearly. From his answer, we understand that DESCO's research and development department has bigger plans than we thought. And they are developing the DESCO's power system continuously.

7.1. Ongoing projects:

Every year DESCO's research and development department makes budget to improve their power distribution system. Now two major projects are running.

- 'Strengthening DESCO's electric distribution network' project is under development in great Mirpur area. The cost of this project is 4,859.20 million taka. Bangladesh Government will finance 229.26 million, 1559.67 million by DESCO and 3070.27 million by ADB. This project will be completed by June, 2012. DESCO estimated that, after complete this project, 120 MW power will added in DESCO's power system.
- Another project is 'Upgrading and expanding distribution system in Gulshan circle'. This project cost is much higher than previous one. The estimated cost is 5949 million taka. 270.30 million taka financed by Bangladesh Govt., 2149.55 million by DESCO and rest of the money financed by ADB. This project will be completed by June, 2012. 210 MW extra power would be distributed in Gulshan area after completion this project.

7.2. Future plans:

- In Gazipur and Narayangonj, a new area is developing name 'Purbachal Model town' by RAJUK. And DESCO is going to distribute power in that area in future. Expected load demand on that area is about 500 MW. So DESCO is making huge design to develop power network in that area.
- Another area, name 'Uttara 3rd phase' is developed by RAJUK. This is the extension of Uttara area, which is already in DESCO territory. The estimated load demand is 230 MW. And everything is under planning to develop power distribution network.
- The most important future plane is a 200 MW power plant near by Mirpur baribad. This plant will run by oil base fuel. But the power plant design is still under planning.

Chapter 08

8. CONCLUSION

Since 1996, DESCO has been doing a good service in power sector. DESCO has made a great change in Dhaka power distribution system. It was a great opportunity to get chance to do the internship in DESCO. The supervisors of DESCO helped us a lot and for them we were able to complete the internship successfully.

We didn't have the chance to learn about all the projects of DESCO, but within the limited time we had gathered a good knowledge about control room operation, grid operation, substation operation etc. We hope this knowledge will help us to be a part of our power sector development.

References

[1]. https://www.desco.org.bd/uploads/attachments/Annual_Report__2010.pdf

This reference is used in section 1.2: Present status and in section 1.3 DESCO progress

[2]. http://www.emt-india.net/equipment_tips/electrical_system/pdf/Diane%20Power%20Factor.pdf

This reference is used in section 3.1: Power factor monitoring and upgrading

Appendix

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

Table 1.2.1: Technical information about DESCO power system

DESCO's Technical info	
Particulars	
Source line	291 Km
Distribution line	3049 Km
Number of substation	22
Installed capacity (Power transformer rating)	770 to 1078 MVA
Max demand	622 MW
Load factor vacuum circuit breaker	53.84%
Number of distribution transformer	4810
Number of feeder	212
132/33 KV grid substation	2
Single Phase	230V ± 10%, 50 HZ ± 2%
Three Phase	400V ± 10%, 50 HZ ± 2%

1.3. DESCO progress:

If we see the records since 1996 to present, we see that all kind of DESCO's progress is positive. That's means DESCO gives good services and people are satisfied with DESCO services. This could happen because of DESCO mission, vision and corporate philosophy.

Mission: to be a role model electric supply company in region using most dependable technologies and be a development partner in the continuous welfare of the society.
Vision: Service to the utmost satisfaction of the consumers through reliable and uninterrupted power supply and provide value for money. Provide congenial working environment for the employees.
Corporate philosophy: Service excellence with integrity and corporate social responsibility.