# DISTRIBUTION OF ELECTRICITY BY DHAKA ELECTRIC SUPPLY COMPANY Ltd (DESCO)

**An internship submitted in partial fulfillment of the requirements for the Award of Degree of**
**Bachelor of Science in Electrical and Electronic Engineering**


**Submitted By**

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**FACULTY OF ENGINEERING**
**DAFFODIL INTERNATIONAL UNIVERSITY**


**January 2020**

# CERTIFICATION

This certify that this internship entitled “DISTRIBUTION OF ELECTRICITY BY DHAKA ELECTRIC SUPPLY COMPANY Ltd (DESCO)” is done by the following student under my direction supervision and this work has been carried by the laboratories of the department of Electrical and Electronics Engineering under the Faculty of Engineering of Department of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of science in Electrical and Electronics Engineering.

**Signature of the candidates**

_____

**Name: Nusrat Imrose**

ID: 161-33-3109

_____

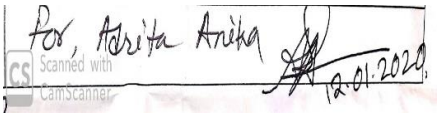
**Name: Swapnil Mitra**

ID: 161-33-3160

# DECLARATION

The project and thesis entitled “DISTRIBUTION OF ELECTRICITY BY DHAKA ELECTRIC SUPPLY COMPANY Ltd (DESCO)” submitted by Name: Nusrat Imrose id: 161-33-3109 and Md. Name: Swapnil Mitra id: 161-33-3160 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering on 31 December 2019.

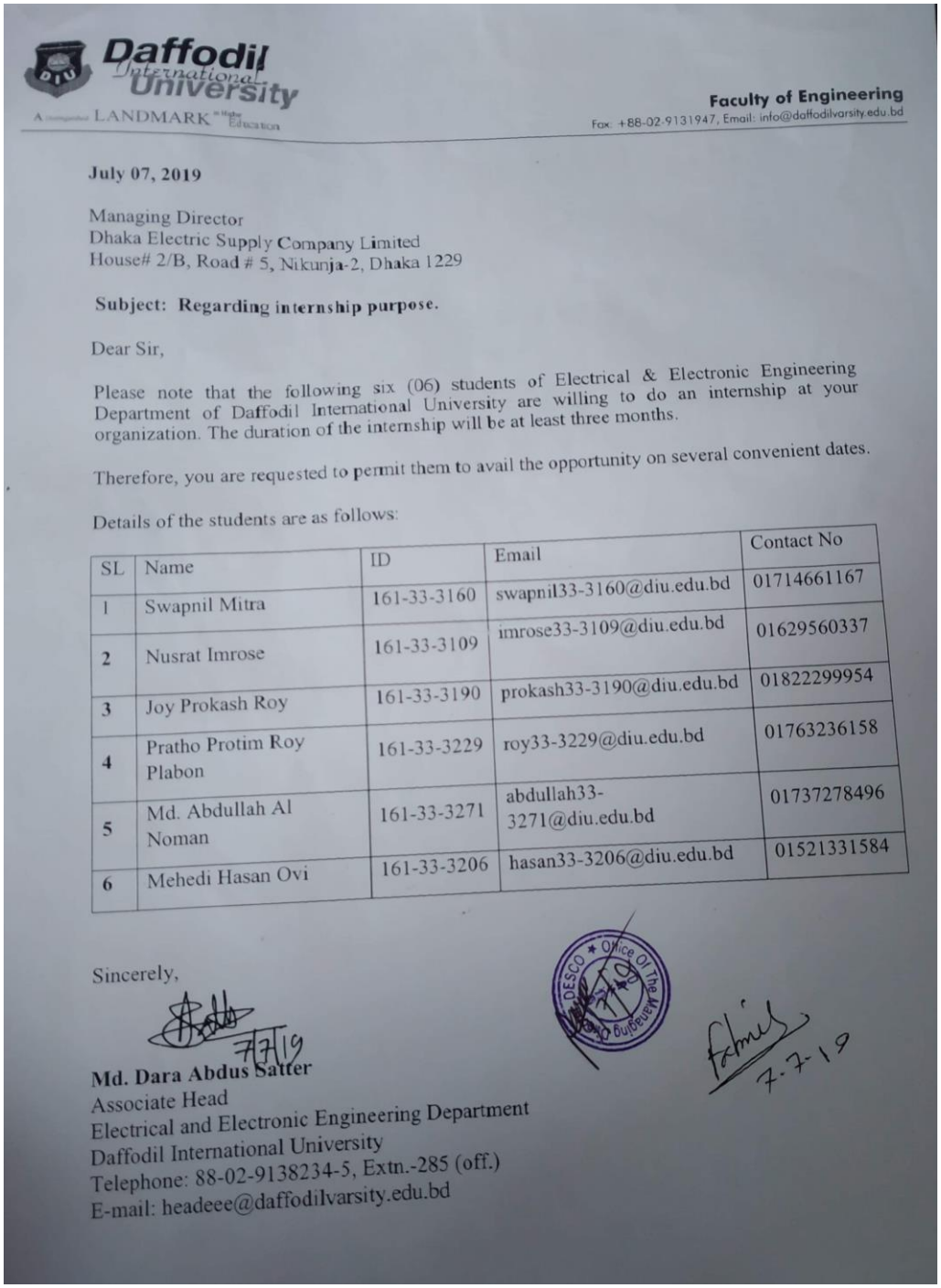
**Signature of the Supervisor**




**Professor Dr. M. Shamsul Alam**

Dean& Professor

# Approval Letter



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**July 07, 2019**

Managing Director
Dhaka Electric Supply Company Limited
House# 2/B, Road # 5, Nikunja-2, Dhaka 1229

**Subject: Regarding internship purpose.**

Dear Sir,

Please note that the following six (06) students of Electrical & Electronic Engineering Department of Daffodil International University are willing to do an internship at your organization. The duration of the internship will be at least three months.

Therefore, you are requested to permit them to avail the opportunity on several convenient dates.

Details of the students are as follows:

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Sincerely,

7/7/19

**Md. Dara Abdus Satter**
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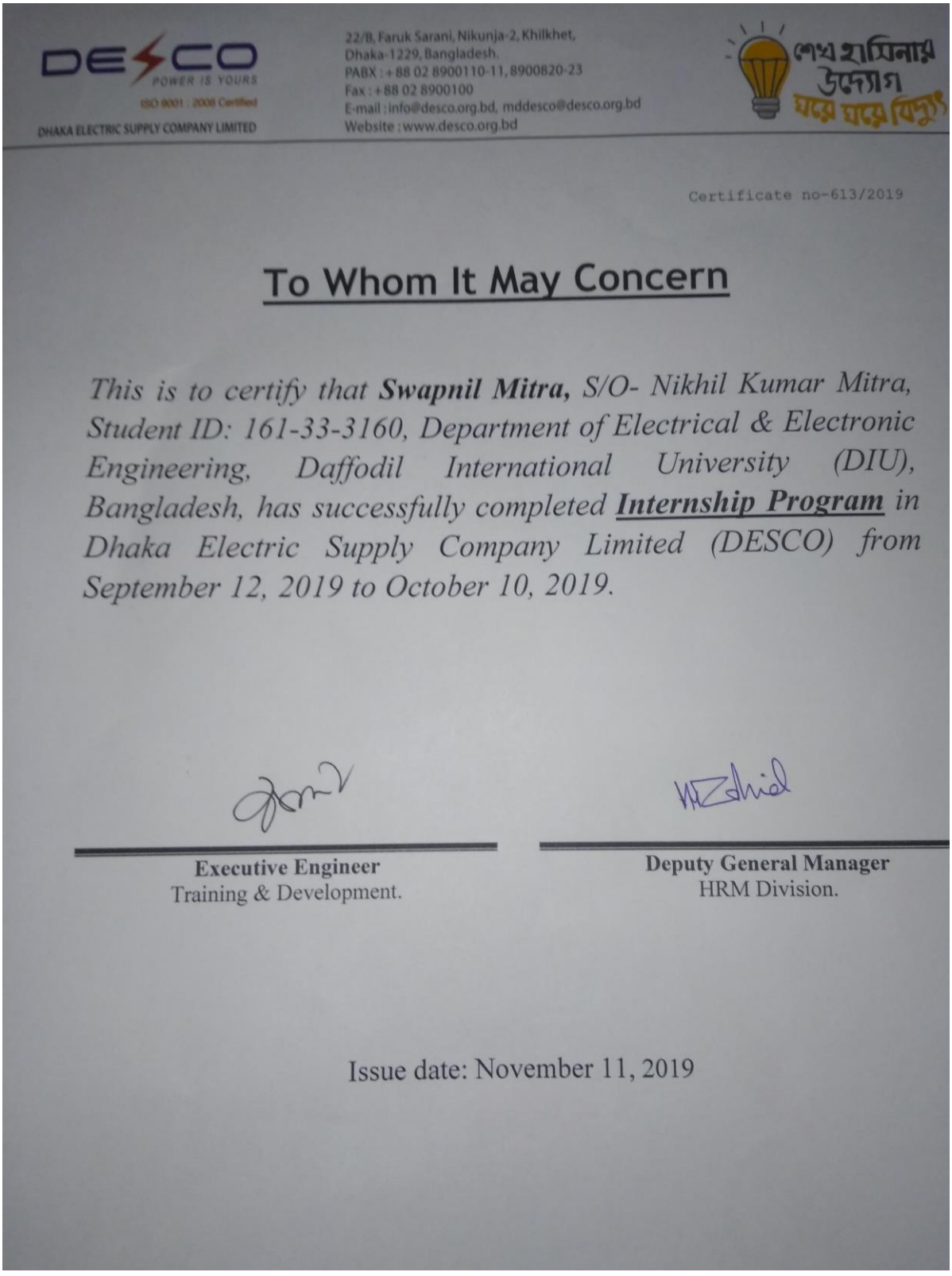
DESCO Office Of The Manager

7-7-19

# Training Certificate



DESCO
POWER IS YOURS
ISO 9001 : 2008 Certified
DHAKA ELECTRIC SUPPLY COMPANY LIMITED

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Certificate no-613/2019

## To Whom It May Concern

*This is to certify that* ***Swapnil Mitra,*** *S/O- Nikhil Kumar Mitra, Student ID: 161-33-3160, Department of Electrical & Electronic Engineering, Daffodil International University (DIU), Bangladesh, has successfully completed* ***Internship Program*** *in Dhaka Electric Supply Company Limited (DESCO) from September 12, 2019 to October 10, 2019.*

**Executive Engineer**
Training & Development.

**Deputy General Manager**
HRM Division.

Issue date: November 11, 2019

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Certificate no-612/2019

# To Whom It May Concern

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**Executive Engineer**
Training & Development.

**Deputy General Manager**
HRM Division.

Issue date: November 11, 2019

**Dedicated to**

# Our Parents

# ACKNOWLEDGEMENT

First of all, we give thanks to Allah or God. Then we would like to take this opportunity to express our appreciation and gratitude to our internship supervisor Professor Dr. M. Shamsul Alam,Dean& Professor of faculty of engineering for being dedicated in supporting, motivating and guiding us through this project.

This project can't be done without his useful advice and helps. Also thank you very much for giving us opportunity to choose this project. We also want to convey our thankfulness to Professor Dr. Md. Shahid Ullah, Head of the Department of EEE for his help, support and constant encouragement.

Apart from that, we would like to thank our entire friends for sharing knowledge; information and helping us in making this project a success. Also thanks for lending us some tools and equipment. To our beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this University.

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| CD | Chromatic Dispersion |
| EMI | Immune to Electromagnetic Interference |
| FBG | Fiber Bragg Gratings |
| FWHM | Full Width at Half Maximum |
| GVD | Group Velocity Dispersion |
| LED | Light Emitting Diodes |
| MD | Material Dispersion |
| NLSE | Nonlinear Schrödinger Equation |
| PMD | Polarization Mode Dispersion |
| PUA | Piecewise Uniform Approach |
| RMS | Root Mean Square |
| SSMF | Standard Single Mode Fiber |
| TFBG | Tilted Fiber Bragg Gratings |
| UV | Ultraviolet |
| WD | Wave-guide Dispersion |

# ABSTRACT

This study includes a brief outline of Dhaka Electric Supply Company Limited's 1-month internship program. In particular, this paper elaborates on the pragmatic approach to the electrical distribution network within the DESCO. This contains all the theoretical and practical skills I gained during my internship. This report focuses primarily on the grid and general substations currently being managed by DESCO, in addition to highlighting some of the successful projects. It also offers an insight into the workings of the company along with its brief introduction.

For clear understanding, all the operations carried out at DESCO have been recorded in different departments. In short, this document was beautifully designed to give the chairman, along with its field experience, a concise overview of the organization. The chances to be connected with the DESCO working team are tailored to specific needs. Division of the meter plant to get to know the different power equipment. My internship began by gaining some basic knowledge of the entire system. After that, I had to go through different kinds of reference books to get acquainted with the surrounding area. In this report, the related theories are also briefed on the practical or visual knowledge. The report discusses the maintenance and protection of the power devices that are the most necessary topics.

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Electricity ought to be a quintessential portion of nature and it is one of our most greatly used types of energy. People get electricity, which might also be an auxiliary vitality supply from the conversion of any other supply of vitality, like coal, natural gas, oil, and atomic control. The unique attribute sources of electricity are referred to as necessary sources. Numerous cities and towns had been constructed nearby waterfalls (essential sources of mechanical vitality) that became water wheels to perform work. And sometime recently electricity is started out fairly over a hundred years prior, homes have been lit with lamp fuel lights, nourishment was cooled in iceboxes, and rooms had been warmed by wood-burning or coal-burning or coal-burning stoves. Electricity may additionally be a body of electricity involving the glide of electrons. All remember is made up of molecules, which has a middle known as a nucleus. The nucleus incorporates emphatically charged particles called protons and uncharged particles known as neutrons. The nucleus of an atom is surrounded through negatively charged particles known as electrons. The terrible charge of an electron is spoil even with to the number of protons. When the adjusting power between protons and electrons is upset by way of an exterior constraint, a molecule may also select up or lose an electron. When electrons are “lost” from a molecule, the free development of the electrons constitutes an electric powered current. It has additionally become a section of present day life. Electrical energy is a quintessential index of the country’s financial & modern progress. At present electrical energy produce via use of herbal fuel such as fuel diesel, petrol, coal, etc. in fuel or diesel engine strength plant in all places use the four-stroke engine. Gas engine strength plant is real looking for little and medium yields. The theme of this report is a learn about on the operation and upkeep of the distribution of electrical energy via Dhaka Electric Supply Company Ltd (DESCO).

Regarding this topic, expertise was once acquired about the running strategies of machinery & In the sub-station and how their upkeep is done. The accountable engineers and people take the crucial movements to overcome these problems. Maintenance after a scheduled time is also completed at several strolling hours of the engine. This report is prepared with related to the study substances from the total graduation length and understanding sensible area of engineering. [1]

## 1.2 Objectives of Internship

- Application of DESCO's organizational management system.
- Gathering energy & transmission transformer awareness.
- Gain awareness of DESCO process security and maintenance.
- Understanding the power system fault and power system safety.
- To grasp DESCO's business operations and process activities.

## 1.3 Scope of the Study

This internship record primarily concerns DESCO's system things to do and enterprise operations. Substation servicing & preservation is one of the mailing elements of machine operations. I additionally determined this transformer thru the time of internship power, which is additionally a vital section of this report. While the internship was in progress, I received training expertise, creating eleven KV deployments & 33 KV community sub-transmission systems. This used to be a fantastic possibility to take a shut look at the DESCO things to do of the engineer.

## 1.4 Research Methodology

During the internship size of one month, the principal goal used to be to accumulate records and records to reflect on consideration on the working environment, think about the tradition and different comparable practices of DESCO. I used to be as soon as assigned in quite a range departments of the Company collectively with the head office, Network operation, enterprise operation, machine operation and etc. This furnished me with the threat to accumulate day out and knowledge via way of the use of working in super departments along with assisting me to have interaction with many one-of-a-kind people. Information about the Working method of DESCO has been amassed through using face

to face conversations with officers and staff, direct dialog with the participants. Initial lectures from the senior officer's realistic work trip in special desks, the study of specific archives and reports of DESCO and the internet website of DESCO.[2]

### 1.4.1 Primary Source

- The data were obtained from employees of DESCO.
- They got all the details.
- Clear comments on the matter**.[2]**

### 1.4.2 Secondary Source

- Different divisions of DESCO
- DESCO website
- Reference books written by several authors
- From my daily notes in DESCO[2]

## 1.5 Internship Outline

**Chapter 1: Introduction**

In this chapter the discussions are about Research Methodology and objectives of this internship.

**Chapter 2: Literature Review**

In this chapter, about reviews the literature knowledge.

**Chapter 3: Company Profile**

This chapter is all about internship Tariff Rate of DESCO and Descriptions of Company Profile.

**Chapter 4: Grid and Sub-Station Operation & Maintenance Discussion**

We discussed about The Grid and Sub-Station Operation & Maintenance Discussion

**Chapter 5: Commercial Operation & Other Systems Of Desco**

We discussed about the Commercial Operation & Other Systems Of Desco.

**Chapter 6: Conclusion**

We discussed about the conclusion.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

The use of electricity in this place (Bangladesh) started in 1901 when a private generator used to be established at the Dhaka Nawab's residence. The Electricity Directorate was shaped in 1948 to prepare and enhance the scenario of electricity supply. The state-owned Bangladesh Power Development Board (BPDB) currently produces round 75% of the energy provided in Bangladesh. The Independent Power Producers (IPPs) and Rental Power Plants (RPPs), which are principally neighborhood and multinational joint ventures, produce the ultimate 25 percentage and sell it via the grid to BPDB. In exchange, BPDB sells electrical energy to the distributors. Nonetheless, a few small IPPs supply direct electricity to the 33 kV distribution community of Rural Electrification Boards (REB). A public enterprise called Power Grid Corporation of Bangladesh (PGCB) Limited owns and operates the grid system. Several public groups such as BPDB, REB, Dhaka Power Distribution Company (DPDC), Dhaka Electricity Supply Company (DESCO), West Zone Power Distribution Company (WZPDCO) each share the responsibility of distributing electrical energy throughout the country.[3]

## 2.2 Power System

The electricity device is a community consisting of a machine of generation, distribution and transmission. This uses the form of energy (such as coal and diesel) and turns it into electricity. It's break up into three parts: [4]

- Generation
- Transmission
- Distribution

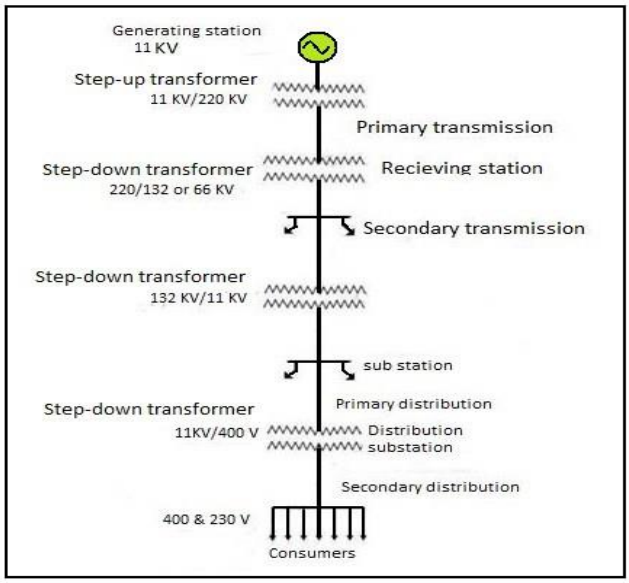


Figure 2.1: Line diagram of power system Bangladesh

## 2.2.1 Electrical Power Generation

Power Plants are power generation plant. In Bangladesh, per capita consumption is solely 220 kWh very low. Today, electricity is handy to about forty seven percent of the complete population. The Bangladesh Power Development Board (BPDB) is the only electrical energy technology authorities authority. The BPDB itself and the Rural Electrification Board (REB) are foremost electricity distribution agencies. In the public and private sectors there are 18 and 25 strength flowers respectively. But the total capability of each the public and non-public sectors for the duration of the peak hour is 5376 MW, of which 3331 MW and 2045 MW share respectively, the public and private sectors. [4]

**2.2.1.a Public sector**

- BPDB
- APSCL
- EGCB
- NWPGCL
- WZPDCL

- REB

#### 2.2.1.b Private Sector

- SPL
- RPCL
- Energy Pac Engineering Ltd

### 2.2.2 Types of power plants

#### 2.2.2.a Steam power plant

The steam-electric power plant is a strength station the place steam is powered through the electric generator. Water is heated, converting into steam and spinning a steam turbine using an electric generator. The steam is condensed in a condenser after it passes via the turbine. Due to the specific fuel sources, the largest variation in the plan of steam strength plants. Bangladesh's solely coal-fired steam energy plant is located in Barapukuria at Dinajpur district. The potential of two gadgets each is 125 MW, i.e. a whole power of 250 MW. The coal-based power plant in Barapukuria makes use of tremendous home coal. A in addition one hundred twenty five MW coal-based electricity plant unit is also being developed at the identical premises.[5]

Figure 2.2: Steam Power Plant

#### 2.2.2.b Hydroelectric power plant

An impoundment plant is the most common type of hydroelectric energy plant, the use of a dam to save river water in a reservoir, an impoundment site, typically a large hydropower system. Water launched from the reservoir passes via a pump, spinning it, triggering a

generator for electricity generation. Between 1962 and 1988, the mills have been commissioned at the 230 megawatts (310,000 HP) Karnafuli Hydroelectric Power Station. It is Bangladesh's solely hydroelectric power station.[5]

**Turbines:** 2 x 40 MW (54,000 HP), 3 x 50 MW

**Installed capacity:** 230 MW (310,000 HP)

**Spillway capacity:** 16,000 $m^3$/s (570,000 cuft/s )

**Total capacity:** 6,477,000,000 m3

Figure 2.3: Hydro Electric Power Plant

### 2.2.2.c Nuclear Power Plant

A nuclear energy plant is a thermal power plant where a nuclear reactor is the warmth source. As is standard of thermal electricity plants, heat is used to generate steam that drives a steam turbine connected to an electric powered generator. As of 2014, 450 nuclear reactors are in operation in 31 countries, states the International Atomic Energy Agency.Nuclear flowers are usually viewed as base load stations because gasoline is a small phase of the manufacturing price and cannot be dispatched easily or quickly. Together with hydropower stations, their operation and preservation and gasoline charges are at the low end of the spectrum and make them ideal as suppliers of base load power.

Nonetheless, the value of managing spent gasoline is truly unknown.Rooppur Nuclear Power Plant is a 2.4 GW nuclear strength plant beneath construction placed in Bangladesh. The nuclear electricity plant is being set up on the banks of the Padma River, 87 miles (140 km) west of Dhaka, in Rooppur (Rupppur), subsequent to Paksey, in the district of Pabna's Ishwardi Upazila. It will be the first nuclear energy plant in the country, and it is predicted that the first of two devices will go into operation in 2023. The Russian Rosatom State Atomic Energy Corporation is building it.[5]

Figure 2.4: Nuclear Power Plant

### 2.2.3 Power Generation in Bangladesh

The strength zone in Bangladesh is rather established on fossil fuels, as herbal fuel and coal are the dominating sources for power technology in the country. About 62.9% of Bangladeshi generated electrical energy comes from natural gas, while 10% is from diesel, 5% comes from coal, 3% of heavy oil, and 3.3% is of renewable sources. Despite the reality that the Bangladeshi energy zone makes use of and covers diverse products; electricity, petroleum products, herbal gas, coal, biomass and solar, but the policy and choice makers are mostly pre-occupied with electricity, as it is the most frequent used form of strength in the country. Thus, due to the fact there is a continuous and rapidly widening gap between electricity supply and demand, consequently it is a essential challenge for the electricity zone in Bangladesh. In 2016, the complete quantity of buyers linked to the grid is 21.8 million. Out of the 21.8 million, sixteen million are domestic connections (households), which would represent roughly 50% of all Bangladeshi households (30-40 million). Another 15% of the households have get entry to to off-grid electricity. Power cuts and the

low reliability of the power grant are the essential problem of the grid extension. Even with newly installed capacities (in total 11,532 MW; 13, 540 including captive energy generation) and the import potential of 500 MW from India. There has been a big growth of the grid infrastructure and other electrification measurements, the electrification price is around 75%, however in reality many households go through from unreliable electrical energy grant with energy outages of up to 14 hours per day. However, the quantity of connections is in fact growing hastily with around 250.000 per month. The furnish of population and industry with modern-day power is very low compared to nations with similar economies. The per-capita production of commercial power increased since 2010 to 371kWh, however is nonetheless one of the lowest in the world.[5]

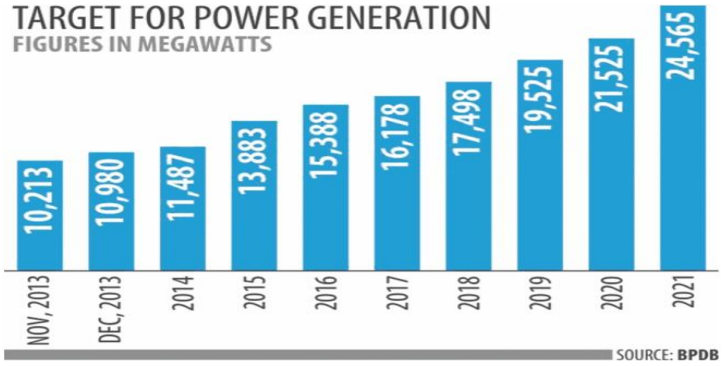


Figure 2.5: Power generation in Bangladesh

## 2.2.4 Electric Power Transmission

Transmission of electrical energy is the bulk switch of electrical electricity from a generating web site to an electrical substation, such as a electricity plant. The interconnected strains that enable this technique are recognized as a community of transmission. This is separate from the nearby cabling between high-voltage substations and consumers, usually referred to as the delivery of electrical power. The integrated transmission and distribution network in North America is recognised as the "power grid" or really the "grid. “The community is acknowledged as the ' National Grid ' in the United Kingdom, India, Tanzania, Burma, Malaysia and New Zealand. Power System is an

interconnected community that links the electrical energy generation, transmission and distribution facilities. In Bangladesh, electrical energy is generated at a frequency of 50 Hz and at a nominal voltage of eleven KV (Kilo Volts) or 15 KV to be accelerated to 132 kV or 230 kV by means of transformers for grid feeding, i.e. a high voltage transmission network that transmits energy to grid substation transformers to be decreased at 33 kV. eleven KV and 0.4 KV voltages are supposed for the furnish of distinctive categories to customers.[5]

## 2.2.5 Power Transmission Lines

A power transmission line can distribute conductor resistance and inductance alongside the length of the line and additionally distribute potential among conductors alongside the line length. A ' quick ' line (less than about 80 km in length) is one for which capacitance can be left out for analysis functions and the resistance and inductance can be assumed to be localized at the line middle besides foremost errors. Then the line can be represented via the network of sequence impedance.[5]

## 2.2.6 Overhead transmission lines

An overhead power line is a system used for transmitting and distributing electrical electricity over massive distances. It consists of one or greater conductors suspended by means of towers or poles (commonly multiples of three). Since most of the insulation is furnished by air, overhead electricity lines are normally the minimum-cost energy transmission manner for huge quantities of electrical energy.[5]

### 2.2.6.a Short transmission line

A short transmission line is categorised as a transmission line of much less than eightykm (50 miles) or much less than 69 kV of nice power. A quick transmission line's productivity (i.e. the efficiency) is as simple as any different electrical equipment's effectivity equation

$$\% \text{ efficiency } (\mu) = \frac{\text{Power received at receiving end}}{\text{Power delivered at sending end}} X\ 100\ \%$$

$$\% \ \mu = \frac{\text{Power received at receiving end}}{\text{Power received at receiving end} + 3I_n^2.R} X\ 100\ \%$$

R is the electrical resistance of the transmission line per step / phase.

Figure 2.6: Short Transmission Line

### 2.2.6.b Medium transmission line

A medium transmission line is described as a transmission line of greater than eighty km (50 miles) but less than 250 km (150 miles) of fantastic length. A lumped shunt admittance is used to measure the ABCD parameters of a medium-length transmission line along with the lumped impedance to the circuit in Series. Such lumped transmission line parameters can be represented the use of three a number of models, which include: nominalπ illustration (nominal pi model), Nominal T illustration (nominal T model) and End Condenser Model.[5]

Figure 2.7: Medium Transmission Line

### 2.2.6.c Long transmission line

A long transmission line with an tremendous size of extra than 250 km (150 miles) is labeled as a transmission line. It is no longer lifelike to presume that the line specs are lumped as applied to brief transmission traces and medium transmission lines. To mannequin a long transmission line effectively, we ought to take into account the genuine effect of the allotted parameters over the whole line span. While this makes it greater tricky to measure ABCD transmission line parameters, it additionally helps us to extract voltage and present day expressions at any factor along the line.

Figure 2.8: Overhead Transmission Line

### 2.2.6.d Underground Transmission Line

Underground transmission is the replacement of underground cables for overhead cables imparting electrical power. This illustrates the superior hearth prevention applied sciences in developed countries which make the electricity traces much less prone to outages all through excessive wind or heavy snow or ice storms. The architectural fantastic of the panorama without the electricity lines is an extra advantage of underground. Under-grounding of electrical transmission line can also increase the capital fees of transmission and distribution of electric powered power, however can also decrease operating prices over the cables ' life time.

Figure 2.9: Underground Transmission Line

## 2.2.7 Electric Power Distribution

Electric strength distribution is the final stage in the supply of electric power; it transfers energy from the transmission system to the buyers and businesses. Distribution substations join to the transmission device and with the use of transformers, transmission voltage is reduced to medium voltage. The vary is from 2 KV to 35 KV. Primary distribution networks relay this moderate voltage to distribution transformers placed close to the doorstep of the consumer. Transformers once more limit the voltage used by lighting, industrial equipment or domestic appliances to the application level. Many consumers are regularly distributed by secondary distribution lines from one transformer. Residential and business customers are linked through demand drops to the secondary distribution lines. Those buyers who want an even heavier quantity of power can be linked directly to the major distribution price or the stage of sub-transmission.[4]

### 2.2.7.a Feeder

Feeder is the "voltage energy line that transfers energy from a distribution substation to the distribution transformers" in the distribution of electricity. Feeder is an electrical wiring circuit in a shape which is a "wire / line" which transports electricity from a transformer or switch equipment to a distribution device.

### 2.2.7.b Distributor

The voltage intensity in the materials is reduced to a point of consumption, and then the electric powered strength is a flow thru the conductors identified as feeders to the exclusive places. The distributor is a conductor in particular location that distributes the electricity.

## 2.2.8 Service Main

A line (conductor or cable) connecting the client to the distributor is referred to as carrier mains. It is configured in accordance to the customer's related load.[4]

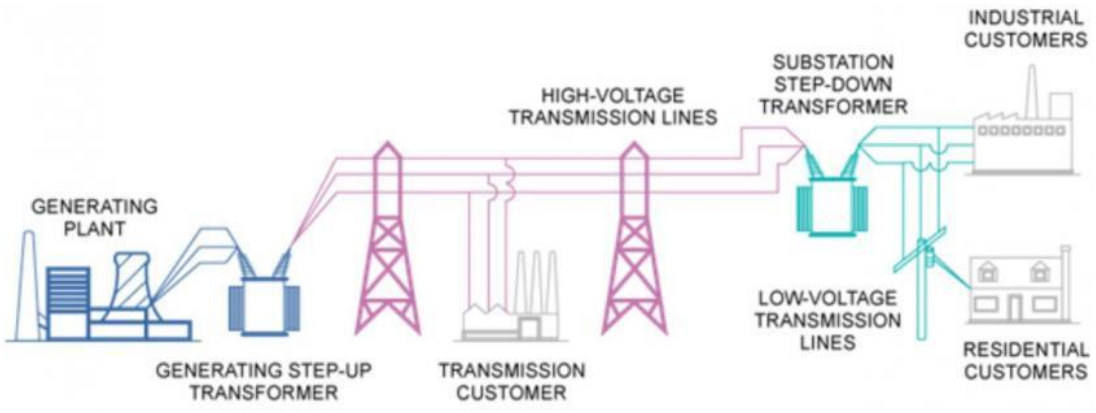


Figure 2.10: Electricity generation, transmission & distribution scheme of Bangladesh

## 2.2.9 Type of Constructions

### 2.2.9.a Radial System

This gadget is solely used when there is a substation or generating station in the consumer's middle. Various feeders emanate from a substation or producing station in this process and feed the distributors at one edge. Thus, a radial distribution system's key characteristic is that the power glide is in one direction only. As proven in the sketch below, there is a one line sketch of a preferred radial distribution network. It is the clearest gadget and its upfront value is the smallest.

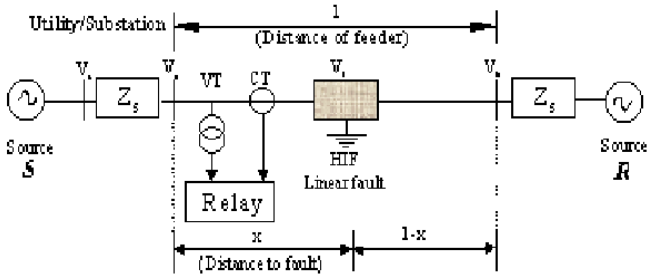


Figure 2.11: Single line diagram of radial system

### 2.2.9.b Ring Main System

Using the Ring distribution system, a constant level of network effectivity to that of parallel feeders can be obtained. Growing distribution transformer is supplied with two feeders, however in multiple directions. The feeders in this community structure a loop beginning from the bus-bars of the substation, running via the distribution transformers of the load location and returning to the bus-bars of the substation. A typical single line layout of a ring important distribution network is shown in the corresponding diagram.[6]

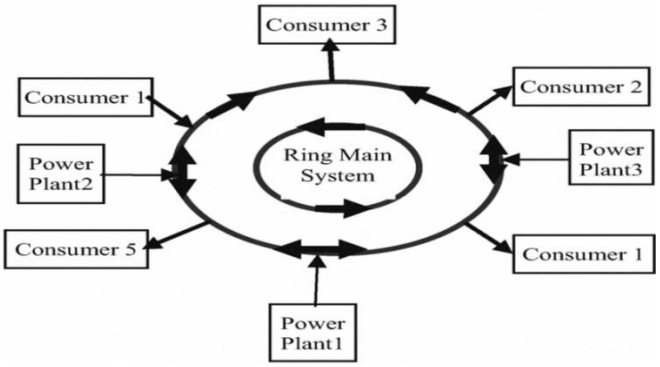


Figure 2.12: Ring Main System

### 2.2.9.c Interconnected System

If two or more substations or producing stations excite a ring foremost feeder, it is referred to as an interconnected distribution system. In case of transmission breakdown, this method ensures reliability. Every region is fed during the peak load periods. two One generating station can additionally be fed from any other generating station or substation as a end result of multiplied demand to meet electricity requirements.[6]

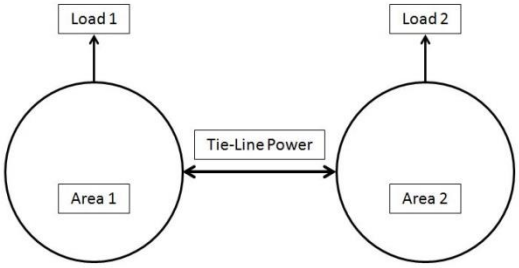


Figure 2.13: Interconnected System

## 2.3 Important terms of power system

### 2.3.1 Real Power

Real strength (P), also recognised as real or energetic power, in an electrical system conducts the "productive work". Real power, calculated in watts, describes the strength absorbed with the aid of the circuit's resistive portion. Both the cutting-edge and voltage are sinusoidal in a simple alternating modern-day (AC) circuit consisted of a grant and a fixed load. The product of voltage and modern-day is superb or zero at any moment, resulting in no reversal of the course of flow of energy

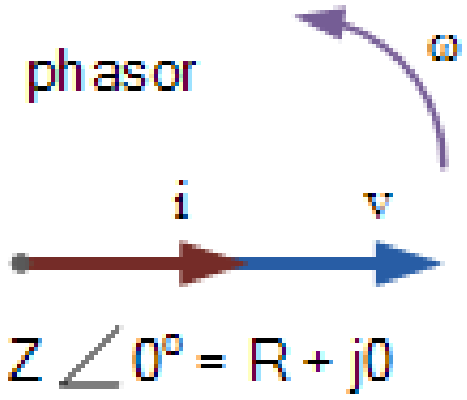


Figure 2.14: Phasor diagram of real power

### 2.3.2 Reactive Power

Reactive strength is the resulting strength of an AC circuit in watts when the present day waveform is out of segment with the voltage waveform, generally with the aid of 90 degrees when the load is only reactive, ensuing from both capacitive or inductive loads.

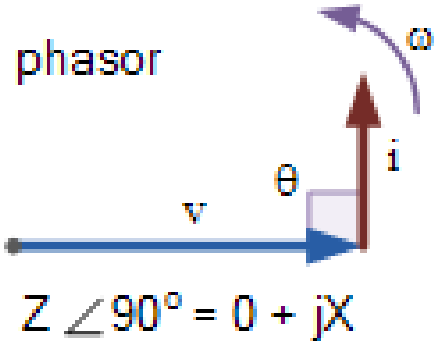


Figure 2.15: Phasor diagram of reactive power

### 2.3.3 Apparent Power

The fusion of reactive energy and actual energy is known as apparent power, and is the result of the voltage and modern-day of a circuit, besides regard to the attitude of the loop. In the Volt-Amps (VA) unit, apparent electricity is evaluated and symbolized by using the capital letter S.

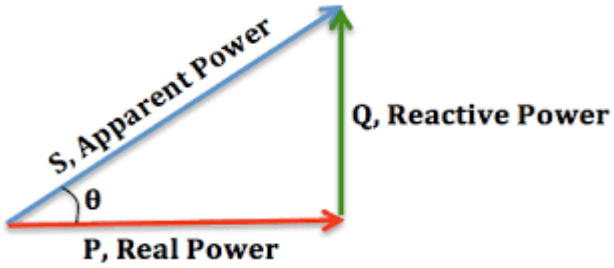


Figure 2.16: Power Triangle

### 2.3.4 Power Factor

The energy thing of an AC electrical energy device is specified in electrical engineering as the ratio of the genuine electricity fed on with the aid of the load to the apparent electricity circulating in the circuit and is a size less extent in the closed interval of −1 to 1. A energy thing of much less than 1 capability the voltage and the present day is no longer in phase, which decreases the two's average product. Real power is the immediate product of voltage and contemporary and demonstrates the working strength of electricity. Apparent power is the modern-day and voltage average output. The obvious power can also be greater than the actual electricity due to the fact of the electricity saved in the load and introduced returned to the source, or due to the fact of a non-linear load that exaggerates the wave form of the current drawn from the source. A poor energy issue tends to happen when energy is generated via the instrument (which is commonly the load), which then returns to the point of origin.

### 2.3.5 Power Factor Angle

A lagging issue and the main power aspect additionally differ. The factors lead to whether or not the present day segment leads or lags the voltage phase. A lagging electricity thing capacity the load is inductive, as the load "consumes" reactive power, and therefore the reactive aspect Q is wonderful as the reactive power passes thru the circuit and is "absorbed" by the inductive load. As the load "supplies" reactive power, a leading strength issue implies that the load is capacitive and consequently the reactive section Q is bad as the reactive energy is delivered to the circuit.

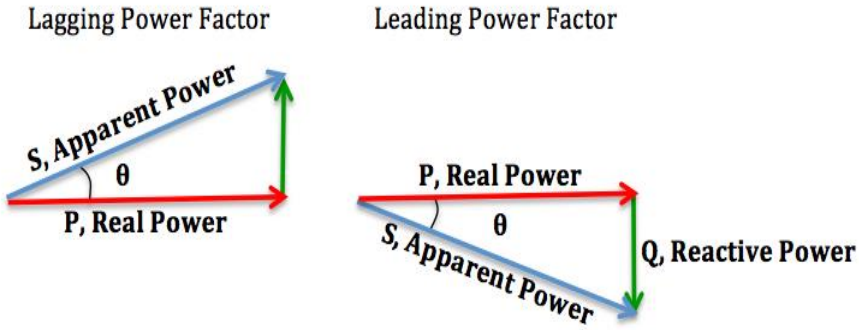


Figure 2.17: Power Factor Triangle

### 2.3.6 Vitality of Power Factor

Power factors beneath 1.0 permit a utility to produce extra than the complete volt-amperes wished to furnish the actual strength (watts). This increases charges of generation and transmission. For instance, if the factor of load energy was once as low as 0.7, the apparent energy would be 1.4 instances the proper load power. The line modern-day in the circuit would additionally be 1.4 instances the current required at a electricity aspect of 1.0, as a result doubling the losses in the circuit (because they are proportional to the modern square). Instead, it would expand the measurement (and cost) of all device factors such as generators, conductors, transformers, and swap tools to lift the greater current. The gathered records from DESCO was exact that, if the power component is monitored less than 92% at any place of the consumers, they have to pay the penalty of 75% of taka for reducing 1% power factor. This procedure is now not only for the customers however additionally for the distributors of strength groups like DESCO, DPDC. If they couldn't preserve the power factor as the given percentage, they have to supply penalty money to the Power Development Board (BPDB).

### 2.3.7 Problems of Low Power Factor

- The device requires a higher current, thereby boosting the device's efficiency.
- The current is high at low power rates, resulting in high system copper losses and decreased system performance
- Higher current generated a significant voltage drop in the device. This results in poor voltage control.

### 2.3.8 Power Factor Upgrading

Improving the PF will optimize current-carrying capacity, enhance gear performance, decrease strength losses, and minimize electrical bills. Adding PF correction capacitors to the electrical gadget is the easiest way to improve the energy factor. PF correction capacitors serve as turbines of reactive current. High-power aspect advantages: minimized copper losses, smaller size of conductor and better law of voltage.

### 2.3.9 System Loss

Losses of electricity are wasted electricity brought about by way of exterior elements or inner elements and dissipated power in the systems. These include losses due to resistance, atmospheric conditions, fraud, Miscalculations etc. and losses incurred between Center (or consumers) distribution sources. ERC eliminates network loss costs to lower power charges for customers. "The reduction of network failure limits is a step to reduce electricity expenses and assist consumers mitigate the effect of growing product and service costs," said ERC Chair Agnes Devanadera.

## 2.4 Faults in a power system

### 2.4.1 Symmetrical Faults

In an electrical system, any irregular electrical present day is a fault or fault current. A short circuit, for example, is a failure where the modern bypasses the ordinary load. In a poly segment system, a fault that is a "symmetrical fault" will affect all phases equally. All the phrases are brief circuited to earth in this type of faults, from time to time to every other. If the shape is symmetrical or a hundred and twenty diploma in three phase axes, this fault is balanced. This fault involves a exquisite deal of current, but it hardly ever happens.

### 2.4.2 Unsymmetrical Faults

This vulnerability only exists when there are one or two stages. When this fault occurs, the three phase lines are unbalanced. This unsymmetrical inconsistency occurs between stages or between stages in the sequence.Single line-to-ground fault (LG).

- Line-to-line fault (LL).
- Double Line-to-ground fault (LLG).
- Three-phase short circuit fault (LLL).

# CHAPTER 3

# COMPANY PROFILE

## 3.1 Background of Bangladesh Power sector

The Bangladesh Power Development Board (BPDB) has reported a large manufacturing of 12,893 megawatts (MW), placing a new file for the country. The record-breaking technology took vicinity in opposition to the projected demand of 14,796MW at 9 pm, observed by means of the previous absolute best output of 12,539MW on May 21, according to the BPDB sources. On June 24, Bangladesh's electricity zone first crossed the 12,000MW mark with the third-highest 12,057MW generation.Prior to that, the peak power technology executed on September 17 ultimate year used to be 11,534 MW, with the preceding report technology on July 18 being 11,387 MW. On July 7 of the identical year, the electricity sector in Bangladesh handed the 11,000 MW level.Earlier, on 19 March 2017, Bangladesh first crossed the 10,000 MW mark, before which the usa produced 9,000 MW of power on 30 June 2016 for the very first time. The established power generation ability of Bangladesh, inclusive of captive power and renewable energy, is 21,419 MW as of Wednesday.The BPDB has taken up an ambitious potential boom plans to add about 11,600 MW over the subsequent 5 years, aimed at generating 24,000 MW of electricity by means of 2021, and 40,000 MW with the aid of 2030, requiring a tremendous expenditure of about $80 billion.The massive investment program is also intended to encompass non-stop electricity supply, representatives of the Power Division said, adding that by way of 2021 the authorities is committed to offering 100% availability of electricity. 90% of the population simply has get admission to to energy.

## 3.2 Rationalization of DESA & DESCO'S Boundaries

### 3.2.1 Description of the Project (for DESA area only)

- Land Development
- Civil works
- 132 kv overhead line
- 132 kv U/G cable
- 33 kv O/H line
- 33 kv U/G line
- Construction of 132/33/11 KV S/S Construction of 32/11 KV S/S
- 11 KV O/H line
- 11/0.4 KV O/H line
- 400 V O/H line
- 11 KV UIG cable
- Pole Mounted S/S
- L T Meters (Single Phase)
- L T Meters (Three Phase)
- HT Meters (Three Phase) TransportNehicle (Different type)
- 10.85 Acres 17253.00 m2
- 31.00 Ckt. km. 15.00 Ckt. km. 43.00 Ckt. km. 71.50 Ckt. km. 8.00 Nos.
- 16.00 Nos.
- 150.00 Ckt. km. 500.00 Ckt. km. 600.00 Ckt. km. 400.00 Ckt. km. 3,000 Nos.
- 2,00,000 Nos. 34,000 Nos. 1 ,000 Nos. 48 Nos

### 3.2.2 Description of the Project (for DESA area only)

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- 400 V O/H line
- 11 KV UIG cable
- Pole Mounted S/S
- LT Meters (Single Phase)
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- 150.00 Ckt. km. 500.00 Ckt. km. 600.00 Ckt. km. 400.00 Ckt. km. 3,000 Nos.
- 2, 00,000 Nos. 34,000 Nos. 1, 000 Nos. 48 Nos.[7]

**Structure of DESCO:** The Company's formal organizational shape includes a hierarchical system. The Chairman and the Board of Directors make up the pinnacle of this structure. The organization's executive head is the managing director below whom the administrative functions are carried out with the aid of 5 govt officers, two regularly occurring managers, two chief engineers, twelve supervisor engineers, two deputy common managers and one enterprise secretary. DESCO has shaped sixteen divisions of Sales & Distribution (S&D) within three organizational zones to expand effectivity in its discipline activities.

## 3.3 Department of DESCO

- Department Sales & Distribution (S&D) Operational Area.
- Division of ICT.
- Substation & department of the network.
- Division of production and project and planning and designing.

### 3.3.1Operational zone and sales & distribution (S&D) division

The Superintending Engineer is in-charge of a zone who supervises the Executive Engineers, the key accountable individual of each S&D Division. Each Executive Engineer accomplishes his obligations by way of two Sub-divisional Engineers, one for system associated things to do and another for business associated activities. Two Assistant Engineers act as assisting physique beneath each Sub-divisional Engineer. System associated activities include scheduled maintenance, troubleshooting and breakdown upkeep of substation and switching stations, troubleshooting of consumer complaints, line & equipment upkeep etc. Commercial related activities include meter reading, distribution of monthly electricity bills, service disconnection of the defaulter consumer, customers' residence wiring inspection, new electric powered connection, meter installation, change of historical or unserviceable meter etc.DESCO has outsourced a group of experienced people for area stage activities, which includes different logistic guide services like protection service, cleansing provider and partial transport service. To this end, DESCO engaged in numerous experienced contractors through competitive bidding process. With the suitable renovation of the distribution system, service complaints from shoppers have been decreased significantly. He manner for new connection has been simplified to acquire higher patron satisfaction and efforts are on to further decrease the common time now taken. DESCO team tries their first-rate to provide a new connection inside 21 working days. To make it greater easy and quick DESCO has launched "Online Application" on 23 February 2012 for new connection and DESCO is the first distribution agency in the united states which has started it.[3]

### 3.3.2 ICT division

The organization has a community of IT professionals on Management Information System (MIS) and on-demand to strengthen new technologies. "E-Governance" is a software hooked up by way of the DESCO IT team that has streamlined the work related with the new link in a very wonderful manner. This team additionally works on an ongoing basis to beautify issue management, monthly billing process and processing, various bill series and clarification, maintain the DESCO website and electronic mail contact, and boost inter-office Wide Area Network (WAN) connection. The DESCO internet site is secured by Secure Sockets Layer (SSL) and a purchaser can effectively use debit or deposit playing cards to pay their month-to-month payment online.[3]

**Substation & network division**

Table 3.1: Sub-station& Network division

| **Name of divisional control centers** | |
|---|---|
| **Name of zone** | **Name of control center** |
| **Mirpur** | Mirpur Control (Kafrul) |
| | Agargaon Control |
| **Uttara** | Uttara Control |
| | Tongi Control |
| **Gulshan** | Gulshan Control |
| | Baridhara Control |

In order to hold these substations, DESCO has 26 33/11 kV substations and has a separate division known as Substation & Network. Under the chief engineer, the division has a Supervisor Engineer, Network Service. This unit is separated into two departments: Maintenance and Commissioning of Medium Voltage Substation (MVSSMC) and Grid & Protection (G&P). Such two divisions furnish services which includes electrical substation inspection, troubleshooting of any system operation, checking out of any substation relay for proper operation, testing and commissioning, and take a look at reporting.DESCO's Central Control, located in Gulshan, is in the unit of Substation & Network for finest coordination and electrical energy dispatch among the 6 divisional monitoring stations. The manage middle is configured with a impervious conversation network, a particular records acquisition gadget (DAS) and a visualization machine for live records acquired from special places to facilitate this. It was additionally counseled that a accurate equipped monitoring and records acquisition (SCADA) gadget for more environment friendly and environment friendly facts management and statistics packaging system be developed.

### 3.3.3Development & project and Planning & design division

Electricity is an innovation that is always evolving and DESCO has two different divisions for Advancement & Project and Planning & Design to be well suited with this growth. two In the following 5 phases, a mission is generally treated by using the undertaking division: [8]Assessment of the feature's need and growth

- Options review and acceptance.
- Execute the concepts.
- Future plans.

## 3.4 Start up to the DESCO

Table 3.2: Start up to the DESCO

| Year | Events |
|---|---|
| **2013** | Online application for recruitment. |
| **2012** | Online application for new connection. |
| **2010** | Launching online bill payment system. |
| **2008** | Inauguration of Data Acquisition System. |
| **2007** | Takeover of Tongi Pourashava and distribution license from BERC. |
| **2006** | Company goes public. |
| **2005** | Inauguration of prepaid metering system. |
| **2004** | Establishment of sales & distribution divisions. |
| **2003** | Takeover of Gulshan area. |
| **1998** | Takeover of Mirpur area from DESA. |
| **1996** | Certificate of incorporation. |

## 3.5 Performance of DESCO

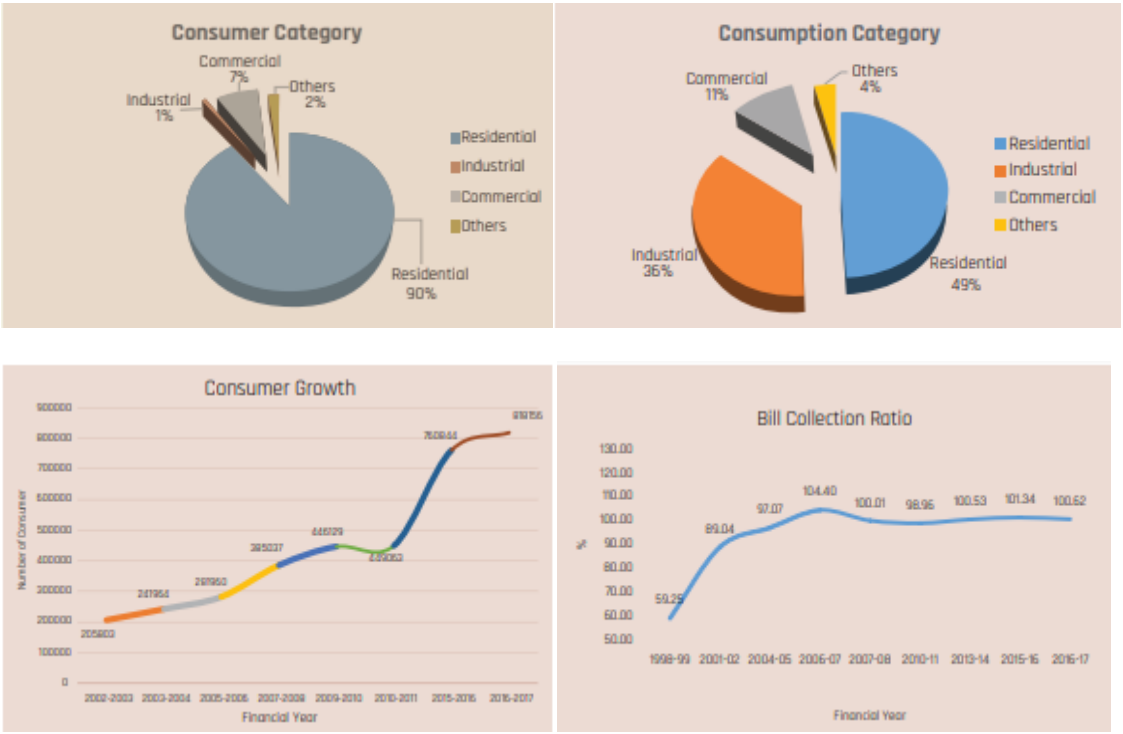


Figure 3.1: Showing the statistics and percentage of DESCO performance

## 3.6 Service Area of DESCO

- JoarShahara S & D Division
- Uttara (West) S & D Division
- Badda S & D Division
- Uttar khan S & D Division
- Agargaon S & D Division
- Rupnagar S & D Division
- Shah Ali S & D Division
- Tongi (West) S & D Division
- Tongi (East) S & D Division
- Dakshin Khan S & D Division
- Baridhara S & D Division

- Uttara (East) S & D Division
- Gulshan S & D Division
- Pallabi S & D Division
- Monipur S & D Division
- Kafrul S & D Division [3]

## 3.7 Financial position of DESCO

Shareholders with the Dhaka and Chittagong stock markets, they had been listed in 2006. Bangladesh's Government of the Peoples ' Republic owns 67.63 percent of the shares owned by the Bangladesh Power Development Board and has scrapped DESA. 21.22% of the institutional traders ' shares and the closing 11.15% of the shares are other shareholders ' shares. Employees More than 1500 at once employed persons and about 1700 not directly (outsourced) employed people for the provision of Commercial Operation Support, Line and Facility Maintenance, Substation Maintenance, Office Safety and Office maintenance. It's the personnel who continually elevate the company's growth.[3]

Table 3.3: Financial position of fiscal year

| S/N | Particulars | Unit | FY 2017-2018 | FY 2016-2017 | FY 2015-2016 | FY 2014-2015 | FY 2013-2014 |
|---|---|---|---|---|---|---|---|
| 1 | Energy Import | MKWh | 5247.841 | 4980.054 | 4795.115 | 4320.976 | 411.067655 |
| 2 | Energy Sold | MKWh | 4870.867 | 4619.282 | 4410.203 | 3959.464 | 376.362349 |
| 3 | System Loss | % | 7.18 | 7.24 | 8.03 | 8.37 | 8.41 |
| 4 | Billed (Retail) | MTk | 36538.864 | 33277.565 | 31478.241 | 27559.773 | 24610.381 |
| 5 | Collection (Retail) | MTk | 36810.053 | 33484.861 | 31900.049 | 27720.080 | 24740.291 |
| 6 | Total Account Receivable | MTk | 5171.049 | 4911.335 | 4440.870 | 4487.791 | 4099.934 |
| 7 | Collection Bill Ratio | % | 100.74 | 100.62 | 101.34 | 100.58 | 100.53 |
| 8 | Collection/Import Ratio | % | 93.51 | 93.33 | 93.21 | 92.17 | 92.07 |

Table 3.4: Financial share position (Stock Exchange)

| Sl. No. | Share Position | May-19 | Apr-19 | Mar-19 | Feb-19 | Jan-19 | Dec-18 | Nov-18 | Oct-18 | Sep-18 | Aug-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01. | Sponsors (%) | | | | | | | | | | |
| 02. | Government (%) | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 | 67.63 |
| 03. | Institute (%) | 23.14 | 23.40 | 23.30 | 23.17 | 23.05 | 22.39 | 22.17 | 22.01 | 21.99 | 21.54 |
| 04. | Foreign (%) | 0.28 | 0.27 | 0.26 | 0.26 | 0.26 | 0.28 | 0.32 | 0.50 | 0.51 | 0.5 |
| 05. | Public (%) | 8.95 | 8.70 | 8.81 | 8.94 | 9.06 | 9.70 | 9.88 | 9.86 | 9.87 | 10.33 |

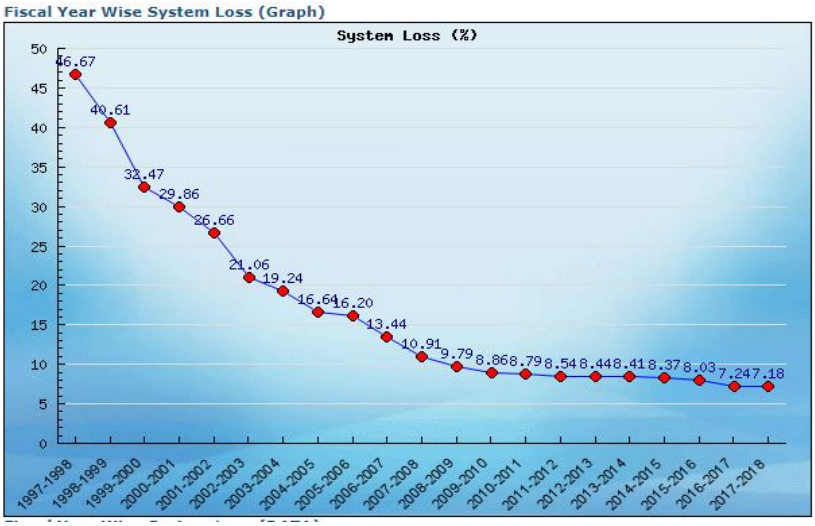


Figure 3.2: System loss (Fiscal year wise)

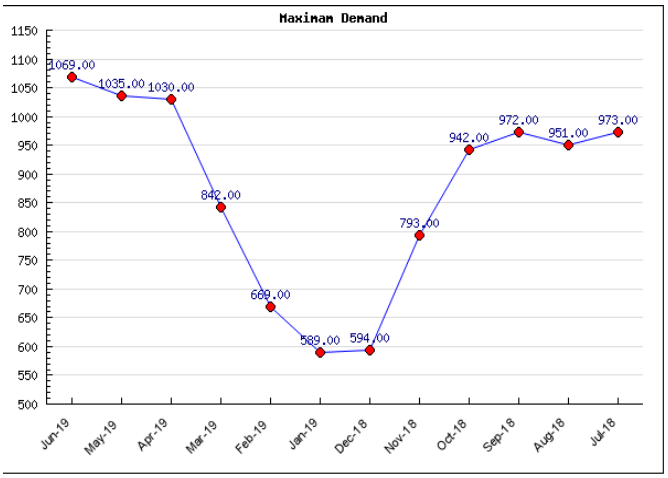


Figure 3.3: Consumer demand graph

Table 3.5: Sales & Collection of DESCO

| Name of Division | No. of Consumers | Import (KWH) | Sales (KWH) | Import (in Taka) | VAT (in Taka) | Billing Amount (TK.) | Collection Amount (Tk.) | Selling Rate (Tk.) | System Loss (%) | Collection Ratio (%) | C.I.Ratio (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agargaon | 54109 | 24946635 | 23998297 | 158288893.9 | 8727998.089 | 174559962 | 181399456 | 7.27 | 3.80 | 103.92 | 99.97 |
| Monipur | 61500 | 26816076 | 26330007 | 170150684 | 10293475.87 | 205869517 | 173686100 | 7.82 | 1.81 | 84.37 | 82.84 |
| Shahali | 52890 | 24727147 | 23981183 | 156896221 | 8902226.469 | 178044529 | 165714859 | 7.42 | 3.02 | 93.07 | 90.27 |
| Rupnagar | 66417 | 40299873 | 38653185 | 255706725 | 14399216.53 | 287984331 | 253504863 | 7.45 | 4.09 | 88.03 | 84.43 |
| Pallabi | 70968 | 33896870 | 32458278 | 215079029 | 11701632.18 | 234032644 | 197992938 | 7.21 | 4.24 | 84.60 | 81.01 |
| Kafrul | 70173 | 32594885 | 31165457 | 206817804 | 11095570.89 | 221911418 | 231874148 | 7.12 | 4.39 | 104.49 | 99.91 |
| Gulshan | 33174 | 68456319 | 66483580 | 434362190 | 29266630 | 585332600 | 541671787 | 8.80 | 2.88 | 92.54 | 89.87 |
| Baridhara | 79591 | 52236749 | 51539891 | 331447396 | 20921620.56 | 418432410 | 402693314 | 8.12 | 1.33 | 96.24 | 94.95 |
| Badda | 55844 | 25342850 | 23845193 | 160802917 | 8962533.25 | 179250665 | 184461657 | 7.52 | 5.91 | 102.91 | 96.83 |
| Joarshahara | 50286 | 50347758 | 49771300 | 319461559 | 19953624.85 | 399072497 | 245983977 | 8.02 | 1.14 | 61.64 | 60.93 |
| Uttara (East) | 64357 | 51479299 | 50166348 | 326641300 | 21202800.87 | 424056017 | 403536615 | 8.45 | 2.55 | 95.16 | 92.73 |
| Uttara (West) | 77161 | 43102233 | 40940316 | 273487978 | 15625687.35 | 312513747 | 271266428 | 7.63 | 5.02 | 86.80 | 82.45 |
| Dakshinkhan | 56087 | 22136856 | 20494875 | 140460565 | 7358061.892 | 147161238 | 138870410 | 7.18 | 7.42 | 94.37 | 87.37 |
| Uttarkhan | 57588 | 22717295 | 20783493 | 144143508 | 7345602.91 | 146912058 | 150836881 | 7.07 | 8.51 | 102.67 | 93.93 |
| Tongi (East) | 50941 | 43902977 | 41889527 | 278568779 | 16300454.7 | 326009094 | 234957230 | 7.78 | 4.59 | 72.07 | 68.77 |
| Tongi (West) | 54108 | 33652702 | 29403142 | 213529759 | 10987976.2 | 219759524 | 174535243 | 7.47 | 12.63 | 79.42 | 69.39 |
| East Zone 1 | 224696 | 168172774 | 162363539 | 1067073068 | 66508845.7 | 1330176913 | 1267697168 | 8.19 | 3.45 | 95.30 | 92.01 |
| East Zone 2 | 226994 | 151752273 | 142242510 | 962883346 | 55836834.68 | 1116736693 | 963865969 | 7.85 | 6.27 | 86.31 | 80.90 |
| West Zone 1 | 268588 | 159941746 | 154335351 | 1014846370 | 58376515.27 | 1167530306 | 947117491 | 7.56 | 3.51 | 81.12 | 78.28 |
| West Zone 2 | 234916 | 116789731 | 112962672 | 741042523.9 | 42322916.97 | 846458339 | 774305278 | 7.49 | 3.28 | 91.48 | 88.48 |
| Total | 955194 | 596656524 | 571904072 | 3785845311 | 223045112.6 | 4460902251 | 3952985906 | 7.80 | 4.15 | 88.61 | 84.94 |

Table 3.6: Tariff Rate of DESCO

| SL | Customer Category and Slab | New Tariff Per Unit Rate (Tk.) Effective from Bill month 1st December, 2017 | Demand Charge (Tk./KW/Month) |
|---|---|---|---|
| 1 | **LT- a: Residential** | | |
| | **Life Line: 1-50 Units** | 3.50 | 25.00 |
| | First Step: From 00 to 75 units | 4.00 | |
| | Second Step: From 76 to 200 units | 5.45 | |
| | Third Step: From 201 to 300 units | 5.70 | |
| | Fourth Step: From 301 to 400 units | 6.02 | |
| | Fifth Step: From 401 to 600 units | 9.30 | |
| | Sixth Step: From 601 to above | 10.70 | |
| 2 | **LT- b: Agricultural pumping** | 4.00 | 15.00 |
| 3 | **LT- c 1: Small Industries** | | |
| | Flat Rate | 8.20 | 15.00 (Applicable for approved demand upto 25 KW) 25.00 (Applicable for approved demand more than 25 KW) |
| | Off-Peak Time | 7.38 | |
| | Peak Time | 9.84 | |
| 4 | **LT- c 2: Construction** | 12.00 | 80.00 |
| 5 | **LT- d 1: Education, religious and charitable organizations and hospitals** | 5.73 | 25.00 |
| 6 | **LT- d 2: Street lamp, water pump and battery charging station** | 7.70 | 40.00 |
| 7 | **LT- e: Commercial & Office** | | |
| | Flat Rate | 10.30 | 30.00 |
| | Off-Peak Time | 9.27 | |
| | Peak Time | 12.36 | |
| 8 | **LT- t: Temporary** | 16.00 | 100.00 |

# CHAPTER 4

# Grid and Sub-Station Operation & Maintenance

## 4.1 Electrical Grid Sub-Station

The gateway between parts of the distribution grid and transmission networks is the electrical substations. Such closed off areas minimize the voltage in the transmission traces down to one that is gorgeous for the distribution grid. These additionally have circuit breakers to impenetrable the distribution community and can be used in multiple instructions to regulate the present day flow. We additionally have variations in smoother and filter voltage due, for example, to more load.[9]

## 4.2 Sub-Station

A substation is a phase of a machine for electrical generation, transmission, and distribution. Substations convert voltage from excessive to low, or back, or operate a variety of other important tasks. Electric energy will drift via a couple of substations at one-of-a-kind voltage levels between the producing station and the customer. A substation would possibly encompass transformers that alter voltage peaks between excessive transmission voltages and smaller distribution voltages, or two particular transmission voltages may additionally be interconnected Substations might also be owned and managed through an electrical utility, or a giant industrial or employer client may additionally very own them. Sub-stations are generally unsupervised and count number on SCADA for far off monitoring and regulation. The time period substation arises from the times earlier than it became a grid for the distribution network. The countrywide generation stations got bigger, smaller generating plant life that had been grew to become into distribution stations

and received electrical energy from a larger plant alternatively than using their own generators. The first substations were linked to simply one electricity station, the place the generators had been placed and where the energy station's subordinates.[9]

## 4.3 Sub-Station Classification

- Transmission substation
- Distribution substation
- Collector substation
- Converter substations
- Switching station
- Mobile substation

## 4.4 According to service requirement:

### 4.4.1 Transformer Sub-Station

An electrical substation that will increase or decreases the AC power system's voltage and also distributes electrical energy. Step-up substations, usually mounted at electrical energy plants, convert the voltage produced by way of the turbines into a greater voltage (of one or greater values) required to switch electrical electricity over power lines. Step-down substations convert a lower secondary voltage into the mains voltage of electrical electricity systems. Step-down substations can be national, principal or local (plant) primarily based on their feature and the principal and secondary voltage values. Geographical substations get hold of electricity mainly from high-voltage electricity lines and relay it to the major step-down substations from which — after reduction to 6, 10 or 35 kilovolts (KV), it is fed to nearby and store substations the place the closing section of transition is finished (with step-downs to 690, 400 or 230 V) and electrical energy is transmitted to customers. Typically a transformer substation appears to have one or two energy transformers, distribution facilities, regulate and defend machinery and auxiliary hardware. Autotransformers can be utilized in a series of high-power step-down substations

(for 220, 330, 500 and 750 KV), as they minimize power losses from 30% to 35%, from 15% to 25% copper consumption and from 50% to 60% steel onsumption.[10


]

Figure 4.1: Transformer sub-station

### 4.4.2 Power Factor Correction Sub-station

Sub-stations that enhance the system's strength component are termed sub-stations for electricity aspect correction. Usually, these sub-stations are located at the receiving quit of transmission lines. Usually, these substations make use of synchronous condensers as the machinery for raising the strength factor.[10]

### 4.4.3 Frequency Changer Sub-station

A frequency changer is a motor-generator set that adjustments power of an alternating current machine from one frequency to one or more extraordinary frequencies, with or without a trade in the wide variety of phases, or in voltage. Sometimes a converter is used to accomplish this.

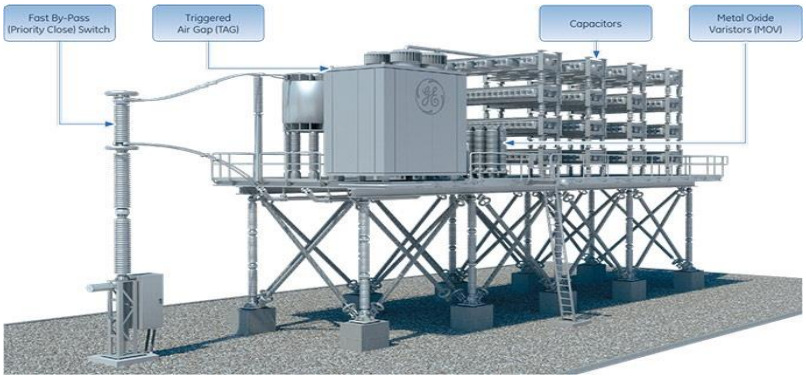


Figure 4.2: Frequency Changer Sub-station

### 4.4.4 Converting Sub-station:

Converter substations are being used in DC energy transmission networks to radically change a three-phase modern-day at the end of the line to a direct modern (rectification) and to perform a reverse transition (inversion) at the quit of the line. An electrical substation is for electrical current conversion — by and large for frequency or section level. It can be used to radically change a business frequency three-phase present day generated by an electrical energy plant into a direct modern to feed, for example, high-power electrolytic equipment, variable-speed electrical drives for machine equipment and rolling mills, galvanic baths, and electrified transport contact systems. Conversion to a varying frequency modern greater or lower than the industrial frequency is used to supply power to appliances such as variable-speed AC electrical drives, induction heating systems, and induction furnaces.[11]

### 4.4.5 Industrial Sub-station:

This Industrial Substation is a water resistant machine for wet, filthy and outdoor circumstances. The station includes of a challenging water resistant and dust proof enclosure (IP -65) made of orange aluminum alloy. The ahead section is centered to the rear enclosure to allow convenient get entry to at some stage in the set up and operation. The station has label-based screw ports and the three glands furnish waterproof and dirt proof connector and loudspeaker electricity cables for configuration.[11]

## 4.5 According to constructional features

### 4.5.1 Indoor Sub-station

A substation in which the equipment is equipped internal the substation building is known as indoor substation. Such kind of substation is in the main used for the voltage up to 11000v, but when the surrounding air is contaminated by impurities such as metallic corroding gases and fumes, conductive dust, etc., their voltage can be raised up to 33000 V to 66000v. As we found a number of sub-stations and Shah Ali S&D division, we were proven there the manipulate room recreation where the indoor sub-station is situated. The devices, wires and safety modules were of the brand new model and had been operated at know-how level. The indoor sub-station has the gain that includes much less space accommodation. That potential the sub-station can be operated effortlessly and requires less area and also price effective. They are heading toward the sketch for their each quarter office. [12]

Figure 4.3: Indoor Sub-station

### 4.5.2 Outdoor Sub-station

A substation that is used for all voltage levels between 55 kV to 765 KV is referred to as out of doors substation. Such kind of substation requires much less time for development but makes use of extra space. The out of doors substations are mostly categorized into two types, specifically pole-mounted substation and foundation-mounted substations. DESCO has many outdoor sub-stations which primarily consist of grid sub-station, however they also have a manage room there too so that they should function or isolate the healthy or

erroneous phase of the device with security as the device has both far flung control and also guide manage features. Their out of doors sub-station needs to improve with extra safety for the area people as they function at high voltage. Their outdoor and indoor sub-station is designed and structured as GIS (Gas Insulating Sub-station). They beforehand had AIS (Air Insulating Sub-station) which had some disadvantages. They nevertheless have some AI (Air Insulator) however the range of them is very less.[12][13]

### 4.5.3 Underground Sub-station

An underground substation is referred to as an extended substation. Typically the underground substation is positioned underneath the closely populated region to grant the electricity to the city. Underground substation charges

- The substation can be built under a building and it will be an effective solution for saving space in city area.
- City planning can be done freely and there will be less impact on the environment.

DESCO currently does not have a subway station. But the underground sub-station can be a great solution to the area problem in a densely populated city like Dhaka[8 ].

Figure 4.4: Underground Sub-station

### 4.5.4 Pole-mounted Sub-station

Using these substations, up to 250 KVA electricity distribution transformers are enabled. Lightning arresters are placed over the excessive voltage line to protect the transformers from spikes. Pole-mounted substations are earthed at two or extra sites.

## 4.6 Bus-bar arrangements in Sub-station

Bus bars are the key elements of a sub-station. Substations have more than one bus bar buildings that can be utilized in a sub-station. Selecting a particular configuration depends on exclusive factors together with system voltage, sub-station location, degree of reliability, cost, etc.[6]

### 4.6.1 Single bus-bar system

Single bus-bar network, which includes a single bus-bar as the name suggests, and is connected to all incoming and outgoing lines. Low capital expense, less upkeep, and easy operation are the main benefits of such system.

### 4.6.2 Single bus-bar system with sectionalisation

An isolator and a circuit breaker hook up any two segments of the bus bar. Two major potential benefits are stated for such an arrangement. First, if any segment of the bus has a fault, this segment can be isolated from the other sections without affecting the supply.

### 4.6.3 Duplicate Bus-bar system

The gadget consists of two bus-bars, a bus-bar "key" and a bus-bar "spare." Using a bus-bar coupler consisting of a circuit breaker and isolator, the inbound and outbound sections can be attached to either bus-bar. The incoming and outgoing lines generally stay connected to the primary bus counter. However, the continuity of grant to the circuit can be maintained through transferring it to the spare bus-bar in the event of repair of the essential bus-bar or fault happening on it. Duplicate bus-bar machine is often used for voltages above 33kV. DESCO has the configuration of reproduction bus-bar gadget as it has the characteristic to do an uninterrupted strength provide alternatively of having a

inaccurate part. They also use it whilst load-shedding if the load demand will increase continuously particularly in the summer time season.

## 4.7 General Equipment's of Sub-station

- Instrument Transformers
- Current Transformer
- Potential Transformer
- Conductors
- Insulators
- Isolators
- Bus bars
- Lightning Arrestors
- Circuit Breakers
- Relays
- Capacitor Banks
- Batteries
- Wave Trapper
- Switchyard
- Metering and Indication Instruments
- Equipment for Carrier Current
- Prevention from Surge Voltage
- The Outgoing Feeders

## 4.8 Operational equipment of transformer

### 4.8.1 Power transformer

The Power Transformer is a single kind of transformer used to ignore electrical electricity between the generator and the main distribution circuits in any component of the electrical or digital system. These are transformers of less power, medium power, and transformers of a larger power. At Shah Ali S&D we say electricity transformers of the organization named ENERGYPAC. But the officers said that this manufacturer desires to enhance its product first-rate as their transformer wishes maintenance after some years. On the different hand, a brand like “MITSUMARU” has proved themselves with an environment friendly product and additionally their cost-effectiveness.[14]

Figure 4.5: Power transformer

### 4.8.2 Working principle of transformer

Transformer is a stationary system that transfers electrical energy without altering its frequency from circuit to circuit. It raises (or step down) the amount of AC voltage and current.

**Working principle**: This promotes the idea of two coils or Faraday Electromagnetic Induction Laws reciprocal induction.

### 4.8.3 Transformers at Sub-station

Substations convert or reverse voltage from high to low, or perform any of several other important functions. A substation may include transformers to adjust voltage levels between high transmission voltages and lower distribution voltages, or two separate transmission voltages may be interconnected.[14]

## 4.9 Transformer Components

### 4.9.1 Winding

Transformers have two windings, the primary and the secondary winding. The coil that extracts electricity from the origin is the main winding. The secondary winding is the coil that transfers electricity to the load at the voltage that has been converted or modified.

### 4.9.2 Main Tank

The transformers that filled Main Tanks completely are supplied with a conservator. It's a tiny tank linked to the Main Tank.

Figure 4.6: Main Tank

### 4.9.3Conservator Tank

The amount of oil in the transformer decreases when the transformer is filled and the ambient temperature grows. A transformer conservator tank provides sufficient storage for this enlarged transformer oil. It also serves as a source for isolating oil from the transformer.

### 4.9.4 Buchholz relay

It is a kind of protective relay powered by oil and gas. It is used to shield a transformer from faults that arise inside the transformer, such as isolating oil impulse breakdown, turning failure in isolation, etc.

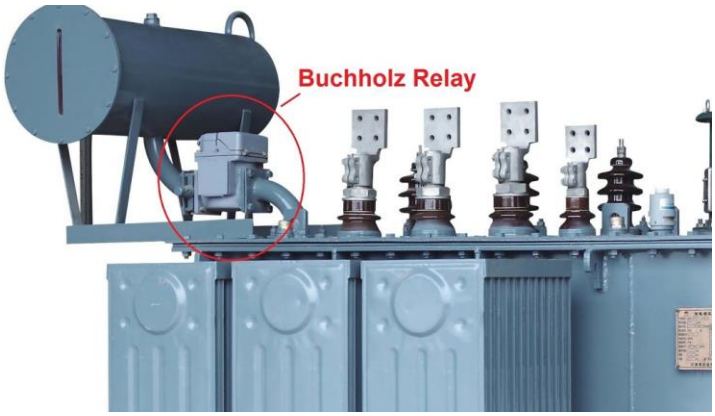


Figure 4.7: Buchholz relay

### 4.9.5 Cooling Equipment

Cooling For Oil Immersed Transformers:

Oil Natural Air Natural Type (O.N.A.N.) Oil Natural Air Forced Type (O.N.A.F.) , Oil Forced Air Forced Type (O.F.A.F.)

### 4.9.6 Winding and oil temperature indicator

The winding temperature is also elevated when the transformer load rises and this additional temperature is felt by feeling the bulb as it is surrounded by the heater coil. The remainder of the winding temperature indicator operating concept is just like the oil temperature indicator concept.

### 4.9.7 On load tap changer

On-load tap changer (OLTC), also recognized as on-circuit tap changer (OCTC), is a tap changer in programs where a disruption of supply throughout a tap shift is undesirable, the transformer is often configured with a more complex and expensive device to adjust the load tap.

### 4.9.8 Transformer Oil

Transformer oil or insulating oil is stable oil with excellent electrical insulating properties at high temperatures. It is used in oil-filled transformers, certain types of high-voltage condensers, fluorescent lamp ballasts, and certain types of high-voltage switches and circuit breakers. The purpose is to separate, suppress the discharge and arcing of corona and act as a coolants.[10]

## 4.10 Losses in a Transformer

### 4.10.1 Core loss/ Iron loss

Iron losses are triggered in the transformer's core by the varying flux as this loss occurs in the core, which is also recognized as core loss. The loss of iron is further split into hysteresis and current loss of eddy.

### 4.10.2 Copper loss

Copper loss is the term usually provided to heat generated by electrical currents in the conductors of transformer windings, or other electrical equipment. Copper losses are an unwanted transition of energy, as are core losses, which occur from induced currents in nearby materials**.** This type of loss is denoted by $I^2R$ loss**.** [13]

## 4.11 Protection systems for transformer

Both windings of a transformer can be individually safeguarded with strictly limited earth defect safety, thus delivering relatively simple machinery for the entire transformer with high-speed immunity against earth defects. A high impedance relay is used, which results in quick activity and stabilization of the phase fault.

## 4.12 Auxiliary Transformer

An auxiliary transformer in a piece of technology is a tinier transformer than the main supply transformer. A master control relay that turns on the main energy source is usually used to energies.

## 4.13 Trolley mounts Transformer

Trolley Mounted Transformer equipped with wheels to make it easy to take from one place to another. In transferring the transformer from one place to another, trolley-mounted transformers are very convenient.[13]

## 4.14 Potential Transformer

Potential transformer is a step-down voltage transformer that decreases the voltage for measurement purposes from a high voltage circuit to a reduced level. Shortly it is denoted as PT.

Figure 4.8: Potential Transformer

## 4.15 Current Transformer

A current transformer (CT) is a type of transformer used to decrease or multiply an alternative (AC) current. In its secondary, it produces a current equal to the current in its primary. Current transformers are instrument transformers along with voltage or potential transformers.

Figure 4.9: Current Transformer

## 4.16 Lightening Arrester

A lightning arrester (alternative lightning arrester) (also known as lightning diverter) is a tool used for the electrical power systems and telecommunications structures to safeguard the system's insulation and conductors from the impacts of lightning damage.

Figure 4.10: Lightening Arrester

## 4.17 Isolators

An isolator is a tool used in isolating a circuit or equipment from a source of power. An isolator is a mechanical switching tool that, in the open position, enables for separation of the input and output of a system.[14]

## 4.18 Battery and Battery charger

In the match of a energy outage, a substation battery charger ensures that all necessary electrical systems in a substation continue to operate. A non-stop charge current continues the battery charged constantly. The charger of the battery generates a contemporary if it reaches the strength of the load. There was a battery room interior the manage room the place the batteries had been saved for backup gadget and as they said, the chemical or distilled water degree is checked every week to keep these batteries. There is an indicator stage on each battery where the percentage of the water stage can be indicated. It is operated and maintained by their professionals to ensure the efficiency and security difficulty as it would possibly me unstable for the armatures to handle.

## 4.19 Circuit Breaker

A circuit breaker is an electrical switch that is automatically controlled to protect an electrical circuit from damage from overload or short circuit caused by excess current. The fundamental function is to interrupt current flow after detecting a fault.

### 4.19.1 SF6 Circuit Breaker

Circuit breakers of sulfur hexafluoride secure electrical power stations and distribution systems by interrupting electrical currents when a safe relay trips. A sulfur hexafluoride circuit breaker uses sulfur hexafluoride gas instead of oil, air, or vacuum to cool and quench the arc when a circuit is opened.

### 4.19.2 Vacuum Circuit Breaker

A vacuum circuit breaker is a type of circuit breaker where the arc is quenched in a vacuum medium. A vacuum chamber in the breaker called the vacuum interrupter is used to turn on and close current carrying contacts and interrelated arc interruption in breaker of the vacuum system. At Shah Ali S&D control room, we noticed vacuum circuit breaker as one of the protection schemes.[15]

## 4.20 Maintenance of sub-station

### 4.20.1 Transformer Maintenance

- The oil level of the main tank and conservator tank MOG (Magnetic Oil Gauge). Also keep filled with oil in MOG to the desired level.
- If the color changes to white, remove the silica gel.
- Seal if any leakage has been found.

### 4.20.2 Transformer Fault Detection and Repairing

#### 4.20.2.a Transformer Coil Burn

The thermostat wires have shortened somewhere in most cases, so the question is the thermostat wires. I saw other parts with coils and circuitry inside the air conditioning system causing the transformer to burn up. The fault is mainly in the wiring of the thermostat.

#### 4.20.2.b Drop out Fuse

Fuses dropped are protective devices that protect systems and hardware against current surges and overloads. The fuse part in the transporter unplugging the line or equipment will be melted by an overcurrent. These also provide insulation points for the system when using a hot stick remotely.

### 4.20.3 Line Maintenance

The transmission lines play a major role in conveying the enormous quantity of electrical power produced at different generating locations over a range of several hundred kilometers to the entire nation from one end to the other. Through this kind of transmission, power can be distributed through substations to the different types of consumers at the lowest possible line losses. Live-line work, also recognized as hotline repair, in electrical engineering is the servicing of electrical devices, sometimes running at high voltage, whereas the machinery is being energized.

## 4.21 Control room activity

The different tasks of surveillance, regulation and safety are carried out in the control room of the substation. In the controlled room, the relays, protective and control panels are installed. In DESCO control room we saw the circuit breakers, power factor monitors which were also showing current rating provided to each area, battery room etc.

## 4.22 Data Acquisition System

The data acquisition system at substation level transmits data to the control house from the UGPSSMs (Universal GPS time-synchronized meters). You can execute this feature across multiple architectures.

## 4.23 Sub-station Monitoring

The Substation Surveillance System (SMS) purpose is to track the power. Transformers, circuit breakers of medium and high voltage, reclosers, dc battery systems, and a disconnect switches of a Sub-station to eliminate the need for new equipment.[16]

# CHAPTER 5

# COMMERCIAL OPERATION & OTHER SYSTEMS OF DESCO

## 5.1 Disconnection/Reconnection

Disconnection happens when the transportation of electrical energy to the property and/or premises is halted by energy stresses. Reconnection is when a property or site is powered or replaced by the power lines by an electrical carrier. There are disconnection / reconnection fee schemes in DESCO. The charge in the LT line is 1500/= (taka) and the charge is 3000/= (taka) for the HT section.

### 5.1.1 Metering

A meter of electricity, an electrical meter, an electrical meter or an energy meter is a device that measures the amount of electrical energy used by a home, company or electrical device. In billing purposes, power utilities use voltage meters located at customer premises. Typically in billing units, they are calibrated, the most common unit known as a kilowatt-hour (kWh). Usually, they are read once every billing period. If energy savings are required during certain times, some meters may calculate demand, maximum power consumption at certain intervals. Determining "Time of Day" allows for modifying electrical levels during a day, documenting use during peak high-cost times and off-peak, low-cost periods. There are also relays for demand response load shedding in certain areas during peak load times.DESCO has various meter testing labs to check the meters properly before installation. When any consumer wants to install a meter in case of a new connection or another purpose, he has to bring the meters to the one-point service of the DESCO office to let them check if there are any errors or faults in the meter. After checking in the lab, the

meters are installed by the employee of the office and it is sealed properly so that it cannot be tempered or damaged. The meter testing process can be lengthy according to the requirement. There are three kinds of impulse rating on meters. They are 1600 imp, 2000 imp, and 3200 imps. According to time, load and impulse the primary error is detected in percentage.[17]

### 5.1.2 One point Service Center

It is a region the place all the consumers can gather all the facts and can resolve their quite a number types of troubles easily. They can accumulate new connection forms, submit documents, can do reconnection tactics and can resolve the hassle of invoice shock by means of checking previous history from their account sanctioned from the office. The personnel test the accounts of the clients from the database, People can post the report to trade the sanctioned identify of the customer or they can add the identify of purchaser if there are numerous owners of the property.

### 5.1.3 Billing & Collection

Consumer's electricity bill shall be organized and mailed on a monthly basis or otherwise delivered. All meters, without these that are no longer comfortably available, are study every month by the cooperative. Readings shall be calculated for those no longer read, but everyday readings of such meters shall be made by using cooperative staff. Billing changes will be made as proven by using these normal readings where appropriate.

### 5.1.4 IT Division

It handles with the software program and web based works of DESCO. The software program is combined with a lot of coding language with a sturdy safety protection. If any problem happens in the software program or database, the IT division solves the problem so that no customer faces any problem. The software program is designed through Oracle 10, Linux, C++ and many different combinations of software languages.

## 5.2 System Operation

### 5.2.1 New Connection:

Consumers who want electrical energy in a new location or property, they apply for a new connection. The new connection expenses according to the load whether it is an LT line or HT line. The consumer can practice on line the place the wiring certificate, fire provider station certificate ought to be connected with different imperative documents. The officers will go to the area to look into all the requirements.[18]


Figure 5.1: Flow Chart New Connection

### 5.2.2 Load Management

Load management is the technique of coordinating the furnish of strength on the machine with the electrical load by changing or regulating the demand as a substitute than the output of the electricity station.[17]

### 5.2.3 Load Sanction

General Formula to calculate the Maximum Demand is described below:

Maximum Demand= Connected Load * Load Factor / Power Factor.

Where, Connected Load = Total Connected load in the facility in kW.

Table 5.1: Load Sanction of residential space

| **Residential Space(sqft)** | **Load** |
|---|---|
| Up to 899 sqft | 2 KW |
| 900-1100 sqft | 3 KW |
| 1100-1300 sqft | 4 KW |
| 1300-1500 sqft | 5 KW |
| 1500-1700 sqft | 6 KW |
| 1700-1900 sqft | 7 KW |
| 2000 and above | 8 KW |

Table 5.2: Load sanction by officials

| **Load( KW)** | **Position** |
|---|---|
| Up to 50 (KW) | Executive Engineer(XEN) |
| 50-100 KW | Senior Engineer(SE) |
| 100-500 KW | Chief Engineer(CE) |
| 500 KW- 5MW | Executive Director(ED) |
| 5 MW | Board of Directors |

### 5.2.4 Load Retention

Actually, load retention charges are charge structures supposed to motivate a purchaser to proceed to take provider from the organization when the client is organized for monetary reasons to depart the program.

### 5.2.5 Load Calculation

The process of determining the correct size of a furnace and/or air conditioner for a home is a load measurement.

## 5.3 Prepaid Metering

Prepaid metering places you to buy electricity in the driver's seat. It's like filling with gas in your vehicle or truck. You monitor the stage of fuel and figure out when to top off it. You can "refuel" by using including cash to your account. Before it is used, you certainly pay for your electricity.[17]

Figure 5.1: Prepaid Meter

# CHAPTER 6

# CONCLUSION

## 6.1 Discussion

It was once a lucky possibility to do an internship at DESCO. I had a lot of opportunities to reap sensible expertise because of doing my internship there. Dhaka Electric Supply Company Ltd is one of the great grounds for realistic for Electrical and Electronic Engineering in our country. I found these theories virtually in DESCO which were learned via me at my University. This corporation gave me an chance to put in force my theoretical knowledge practically. The industrial coaching provided by way of DESCO has enriched my practical knowledge. It has broadened my capability of questioning about sensible operations of the extraordinary Equipment. It has improved my self belief level for dealing with job interviews in the future. I have obtained a unique journey of gazing the tools of Sub-station. The clean and pleasant surroundings in DESCO inspired me to co-operate with every other. The realistic understanding training at DESCO will assist me in my whole existence of a career.

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