Internship Report
on
Dhaka Power Distribution Company

By

Md. Imran Jony
Md. Saiful Islam
Fahria Binte Islam

Submitted to the
Department of Electrical and Electronic Engineering
Faculty of Sciences and Engineering
East West University

in partial fulfillment of the requirements
for the degree of
Bachelor of Science in Electrical and Electronic Engineering
(B.Sc. in EEE)

Fall, 2010

Approved By

17.01.11

S. M. Shahriar Rashid
Academic Advisor

Dr. Md. Ishfaqur Raza
Academic Advisor

Dr. Anisul Haque
Department Chairperson

APPROVAL LETTER

To whom it may concern

This is to certify that Md. Imran Jony, student ID 2006-2-80-036; Md. Saiful Islam, student ID 2006-3-80-001 and Fahria Binte Islam, student ID 2006-3-80-012 have successfully completed the project work that was assigned to them as part of the internship program. I, Mr. Ataul Haque, on behalf of Dhaka Power Distribution Company (DPDC) Ltd. am recommending this work as the fulfillment for the requirement of EEE 499 Industrial Training. I wish them success.

Mr. Ataul Haque

Md. Ataul Haque
General Manager (P&D)
(In-charge)

DHAKA POWER DISTRIBUTION COMPANY LIMITED
(An Enterprise of the Government of the People's Republic of Bangladesh)

Biddut Bhabon (11th Floor)
1 Abdul Gani Road
Dhaka-1000
Bangladesh

Phone : +880-02-9563774
Cell : +88-01713 255007
Fax : +88-02-9566518
E-mail : gmpnd@dpdc.org

ACKNOWLEDGMENT

First of all we are very grateful to Dhaka Power Distribution Company Ltd. for giving us the opportunity to complete our internship in their Organization. We want to specifically mention Md. Abdus Sobhan, who is the Managing Director of DPDC for his support during the internship program. We also want to mention Mr. Ataul Haque, who is the Deputy General Manager of System Planning, Design, Policy & Standard Documentation department for his guidance during the internship program.

We are grateful to our honorable supervisor Dr. Md. Ishfaqur Raza, Associate Professor, Department of Electrical & Electronic Engineering, East West University and S. M. Shahriar Rashid, Research Lecturer, Department of Electrical & Electronic Engineering, East West University for providing their constant guidance throughout the course of internship report work on DPDC. We are extremely grateful for their kind supervision and advice.

We would like to mention the name of Dr. Anisul Haque, Chairperson and Professor, Department of Electrical & Electronic Engineering, East West University for being very kind during the period of our internship. We also thank our family and friends for giving us inspiration and unconditional support throughout the internship program.

Finally we thank almighty Allah for completing the internship successfully.

EXECUTIVE SUMMARY

Electricity is the basic infrastructure of today's modern development. But unfortunately this is the most painful suffering and crisis of Bangladesh. We are having huge shortage. This shortage will continue for years unless something is done under Crash program. The adverse impact of electricity shortage is enormous. Every sector is affected and our economy is going to sink. At present Experts has opined no improvement of Power supply for next 3-4 years.

Electric power outages and restrictions on peak-period consumption were a serious problem in the mid-1980s, resulting in substantial productivity losses for jute, textile, and other industrial concerns. Only 47% population of Bangladesh has access to electricity which is very low compared to other developing countries. This power crisis is slowing down the economic growth of the country. Government and power board authorities worked out a strategy of planned load shedding, which were distributed geographically as equitably as possible to minimize economic disruption. Some industrial concerns adopted off-peak work schedules, operating their factories in the middle of the night instead of in the daytime.

There were also substantial losses in the transmission and distribution of electric power, including many unauthorized hookups to the system. The urban distribution system found it difficult to persuade subscribers, including state-owned industries, to pay their bills.

We can reduce Electricity crises by reduction of Losses of electrical system. The Results are Revenue increase, Load shedding decrease. Public will be discouraged to go for electricity theft, Moral of department goes up with the new administrative power.

Bangladesh present System loss is not healthy compared to many developing countries. It can easily be reduced by 5% including Transmission & Distribution losses assuming 1 MW plant cost taka 4 Crore, it will save at least 1000 Crore and construction period of 3-4 years. Additional cost for reduction of losses can be met from the savings. This will be a real achievement for Power sector. But this can only be achieved with sincerity honesty & hard work. But above all we need to have transparent and accountable system where everybody should be accountable.

The most shocking problem in the power sector has been with the distribution system. The Government of Bangladesh has taken an initiative to categorize the Power Sector in the form of Public Limited Companies. The primary aim of creating DPDC and make it operational in the year of 2008 was to provide better consumer service and to improve revenue collection.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. OBJECTIVE

1.1. Objective of the Internship

To fulfill my Undergraduate degree The Internship program has been undertaken as part of credit completion requirement. The internship program serves to reinforce and strengthen the students' personal values and career objectives through an improved understanding of themselves and the working environment, Assist students in identifying and acquiring the skills needed to enter a chosen field, provide practical work experience to balance the students' theoretical training and allow students to meet and learn from professionals in the field and develop a network of contacts. The department of Electrical and Electronic Engineering, East West University has develops strategies to combine Theoretical knowledge with the real world experience.

The purpose of this report is to explain in writing what we have learned from the internship program. The motivation to do an internship is to acquire real life experience in advance to cope up and deal with practical knowledge. By the prescribed guidelines of EEE department, Internship supervisors and DPDC we present a comprise internship report which mirrors our overall internship work in a fruitful way.

1.2. Scope and Methodology

The Methodology to collect and process the data is a systematic way. Data collected both from DPDC's own documents and sometimes from outer sources. But this is true that DPDC's data collection is difficult due to confidentiality. We work on total seven departments of DPDC. So we have to collect the data both in printed and own written manner. In secondary level data collection we depend on Internet and DPDC's own website for relevant information. The analysis in the project part is based on how to conduct a project, System planning, Designs, Policy, tenders and system operational division. We also have some visit to the grid substation at Narinda, Stadium and SCADA of Dhanmondi. We have seen the distribution line and operation of Substation. In a word this report will give a short scenario of how the administrative and technical work is associated side by side in a Power company. We hope this report will be helpful for the students who have interest to work on power system as well as administrative sector.

The project has some limitations, which must be mentioned for the sake of reader's understandability. Some of the data were taken from the internet, though the combination of practical work is involved in the report efficiently. Most of the data used in this report are government published data on power sector, so the verification of this data is not possible always. Lastly the limited knowledge of the analyst, who is preparing such an internship report for the first time, has some effect also.

1.3. Internship Schedule

For Internship purpose we went to Dhaka Power Distribution Company Ltd. (DPDC) Head office at 1, Abdul Ghani Road behind Press club. We visited at Narinda grid sub-station and RMU of stadium which are operated by DPDC. We also have visited control room of SCADA at Kataban, Dhanmondi. In head office we learned about project, planning, design and development of DPDC's system. Internship schedule is given bellow in Table 1:

Table 1: Internship Schedule

Office of the Manager	Start and Completion Date	
Project Planning	15-05-10	22-05-10
Design – 1	29-05-10	05-06-10
System Planning	12-06-10	19-06-10
Policy Standard and Documentation	26-06-10	03-07-10
Design – 2	10-07-10	
Design – 3	17-07-10	
System Operation and SCADA	24-07-10	

2. OVERVIEW OF DPDC

2.1. Introduction

Electricity is a key ingredient of socio-economic development of the country. Adequate and reliable supply of electricity is an important pre-requisite for attracting both domestic and foreign investment.

Reliable supply of electricity is a pre-condition for poverty reduction and economic development. In Bangladesh, 47% of total populations have access to electricity but reliable and quality power is still far away. In order to achieve desirable economic growth rate, electricity growth needs to be achieved by 10%. By best utilizing the natural, human and agricultural resources the desired pace of GDP growth could be attained by increasing electricity generation at much higher rate, which is the key target for development.

Government of Bangladesh has made vision and policy statement for power sector development. It is government's constitutional responsibility to provide electricity to all. In the vision statement it was mentioned that providing access to affordable and reliable electricity to all the people of Bangladesh by 2020 is a befitting national goal to usher the next millennium.

Bangladesh's energy infrastructure is quite small, insufficient and poorly managed. The per capita energy consumption in Bangladesh is one of the lowest (136 kWh) in the world. Noncommercial energy sources, such as wood, animal wastes, and crop residues, are estimated to account for over half of the country's energy consumption. Bangladesh has small reserves of oil and coal, but very large natural gas resources. Commercial energy consumption is mostly natural gas (around 66%), followed by oil, hydropower and coal.

Problems in the Bangladesh's electric power sector include corruption in administration, high system losses, delays in completion of new plants, low plant efficiencies, erratic power supply, electricity theft, blackouts, and shortages of funds for power plant maintenance. Overall, the country's generation plants have been unable to meet system demand over the past decade.

2.2. Background of Electricity in Bangladesh

Dhaka, the capital city of Bangladesh is an ancient city. There is a public saying that Nawab of Dhaka installed a small generator in his residence "Ahsan Monjil" and started generating power at 5pm on 7th of December 1901, which is considered as the introduction of electricity in the Dhaka city. Later, in and around 1930, M/S. DEVCO, a subsidiary of M/S. Octavians Steel Company, developed electricity distribution system at 400V level under complete private ownership and brought that for public use. Most probably in the year 1933 a power generating station named "Dhanmondi Power House" was established with two 1500 KW generators each and from there the electricity distribution system was started to sale to the public on commercial basis.

After partition of the Indian sub-continent in the year 1947, power generation, transmission and distribution authority in the East Pakistan region were confined within some private companies. The electricity supply in the 17 districts was limited to the township areas only for a limited time (i.e. for use during night time only) except Dhaka city area. At that time other than some private companies, power was used to be generated by some isolated industries like tea, sugar, textiles and railway workshops. In aggregate, the generation capacity of this region was about 21 MW at that time.

To cope up with the growing power demand of this region, the then Govt. of Pakistan created Electricity Directorate in 1948 to plan and improve power supply. In 1957 the Govt. took over the private owned companies in Dhaka and placed them under the Electricity Directorate for power generation and distribution.

In 1959, East Pakistan Water and Power Development Authority (EPWAPDA) was established to look after generation, transmission, distribution and sale of electricity throughout the province of the then East Pakistan. After the independence of Bangladesh in 1972, Bangladesh Power Development Board (BPDB) was created to look after the same function.

To improve services to the consumers and to enhance revenue collection by reducing the prevailing high system loss, Dhaka Electric Supply Authority (DESA) was created by an ordinance promulgated by the President of the Peoples Republic of Bangladesh in 1990. Dhaka Electric Supply Authority, headed by a Chief Engineer under BPDB used to control the electricity distribution and sales in Greater Dhaka District area up to September 1991.

2.3. Power Sector

The power sector has three different sectors like Generation, Transmission and Distribution. Bangladesh electrical power sector is presently organized in this manner. Under the Power Division, Ministry of Power, Energy and Mineral Resources is commanding all the organization listed below and Fig.1 shows the organogram of all the electrical power companies of Bangladesh:

Generation (Generate electricity at power stations)

Bangladesh Power Development Board (BPDB)
Ashuganj Power Station Company Ltd (APSCL)
Electricity Generation Company of Bangladesh Ltd. (EGCBL)
North West Zone Power Generation Company Ltd.(NWZPGCO)
Rural Power Company Ltd. (RPCL)
Independent Power Producers (IPPs)

Transmission (Transmit energy through long transmission wire around the country)

Power Grid Company of Bangladesh Ltd. (PGCB)

Distribution (Distribute energy at different consumer level)

Bangladesh Power Development Board (BPDB)
Rural Electrification Board (REB)
Dhaka Power Distribution Company Limited (DPDC)

Dhaka Electric Supply Company (DESCO)
West Zone Power Distribution Company Ltd. (WZPDCL)
North West Zone Power Distribution Company Ltd. (NWZPDCL)
Polli Bidyut Shomiti (PBS)
South Zone Power Distribution Company Ltd. (SZPDCOL)

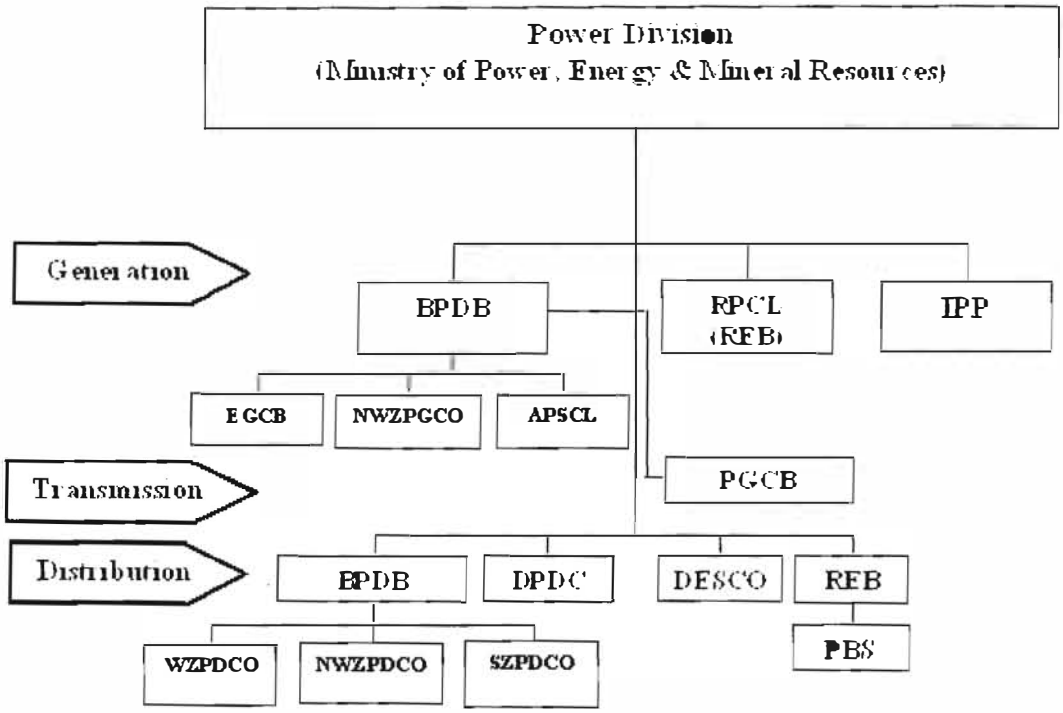


Figure 1: Power Sector of Bangladesh in Present

2.4. Creation of DPDC

Dhaka Power Distribution Company Limited (DPDC) is a Public Limited Company under Powe Division of Ministry of Power, Energy and Mineral Resources of Government of the People' Republic of Bangladesh.

Dhaka Power Distribution Company Limited (DPDC) was registered on 25 October, 2005 under th Companies Act, 1994. The company was entitled to perform business from the date of incorporation The DPDC took over DESA on 1st July 2008 and so started commercial operation on the date take all Assets and Liabilities of DESA through Transfer agreement dated 11 September 2008. Fig. shows the roadmap from the beginning of DPDC up to present stage.

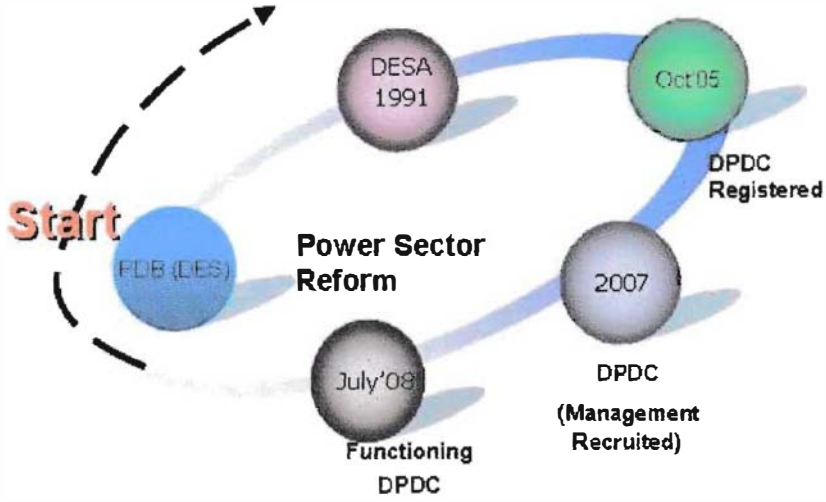


Figure 2: Roadmap of creation of DPDC

Moto - (Dependable Power - Delighted Customer)

It is the inspiring slogan for a company for the quality services for their consumer. Dependable power states that uninterruptible supply of energy and the consumer will be delighted by DPDC's services.

Vision To provide quality and reliable electricity to the people of Dhaka Metropolitan City and Narayangonj area for economic, social and human development.

Mission Mission indicates the present services and the functional activities of a company. DPDC has the following mission statements:

- To deliver quality electricity at reasonable & affordable prices with professional service excellence.
- To make electricity available to all citizen on demand by the year 2021.
- To provide specialized skilled services in electricity distribution for promoting competition among various power sector entities.
- To ensure improved, satisfactory and quick services to the consumer.
- To develop new mindset for all of the employees congruent with corporate culture.
- To reach self-sufficiency by increasing income and reducing expenditure.
- Commitment

DPDC are committed to give efficient services 24/7 to their customer. They have the following commitment statement:

- Quickest response to customers' appeal.
- Our initiatives are designed to match the changing need of the customers.
- Digitalization of Distribution and Customer's Support System.
- Uninterrupted quality power supply to all customers.

2.5. Area Covered by DPDC

The Company was created as a part of the Power Sector Reform Program. It was created to provide electricity to customers of Dhaka City Corporation area (excluding DESCO area) including Narayangonj town, Siddirgonj, Demra, Fatullah and Moktarpur under Narayangonj district.

Dhaka City Corporation area:

Dhaka city is divided into four different zonal area to provide services efficiently.

- North Zone: Mohammadpur, Sher-e- banglanagar, Tejgoan Industrial area, Rampura TV road and Basabo area.
- South Zone: Buriganga river area
- East Zone: Shitolakhha river area
- West Zone: Turag river area

2.6. Electricity System Statistics of DPDC

Infrastructure and total system statistics of a power company is mentionable due to visualize the overall service component under them. The number of equipments of DPDC like transformer, S/S, Distribution line as well as area covered for electrical distribution is listed in a Table 2 below:

Serial No.	Description	Quantity
1	132/33 KV Substation	12 nos
2	33/11 KV Substation	34 nos
3	132 KV Transmission Line	224 km
4	33 KV Line	284 km (overhead -122.25 km & cable -161.150 km
5	11/.4 KV Line	3546 km
6	11/.4 KV Distribution Transformer	9441 nos (single phase- 174 & three phase- 9267)
7	Total number of substation	46 Nos
8	Total area covered	350 sq. km
9	Total electricity line	4054 km
10	Maximum electricity demand	1138.42 MW (30/03/10)
11	Per year load increase rate	8.8 %

Table 2: Infrastructure of DPDC

2.7. Core Management of DPDC

Executive Directors

- Managing Director- 1 post
- Director (Engineering) - 1 post
- Director (Operation) - 1 post
- Director (Finance) (In Charge) - 1 post

Manpower

- Authorized number of post: 2896 (Officer - 713 & Employee - 2183)
- Contractual based number of post: 2571 (Officer - 609 & Employee - 1926)
- Casual based number of post: 1382

2.8. Organogram

An organogram is a diagram that shows the structure of an organization and the relationships and relative ranks of its parts and positions or jobs. Fig. 3 shows the organogram of DPDC.

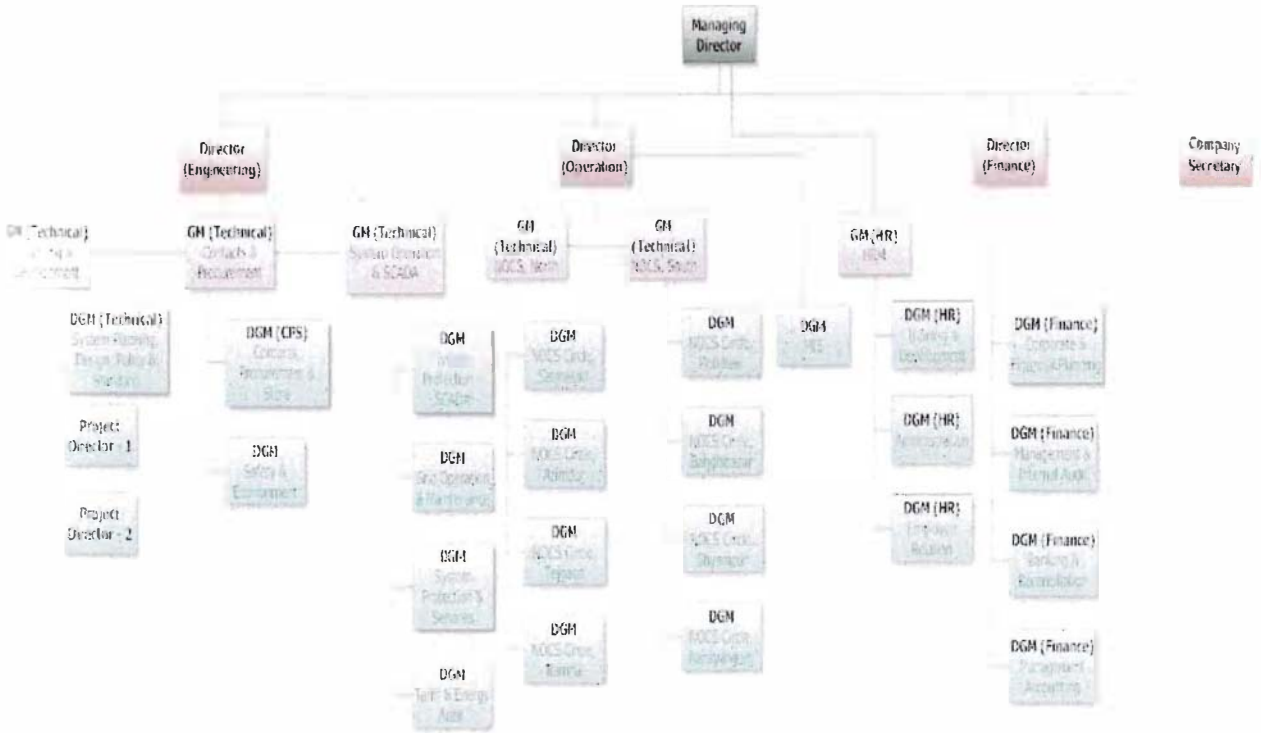


Figure 3: Organogram of DPDC

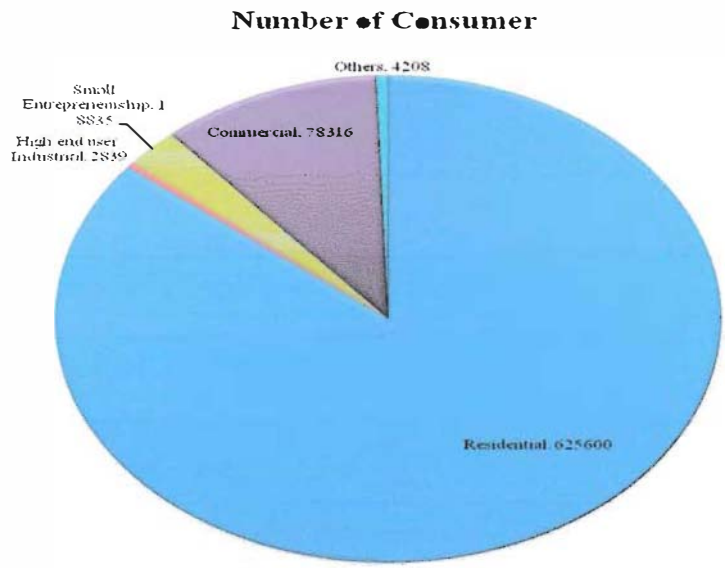
2.9. Number of Consumer and Uses Elec ricity

In the field level there are two (2) General Manager and under them there are eight (8) Deputy General Manager and under them there are thirty two (32) Managers. They all manage electricity distribution system and commercial operation.

Total number of customer of DPDC are 7, 29,798 (up to February 2010). The description of customer and categorized customer based uses of percentage of electricity are given below (up to February 2010).Table 3 and Fig.4 show the table and graphical representation of the total number of DPDC consumers from inception to February, 2010 and its category type consumer mix and usage patterns.

Type of customer	Number of customer	Uses rate of electricity (%)
Residential	625600	38.37
High end user/ Industrial	2839	40
Small Entrepreneurship	18835	11.85
Commercial	78316	8.66
Others	4208	1.11
Total	729798	100

Table 3: Electricity used by DPDC



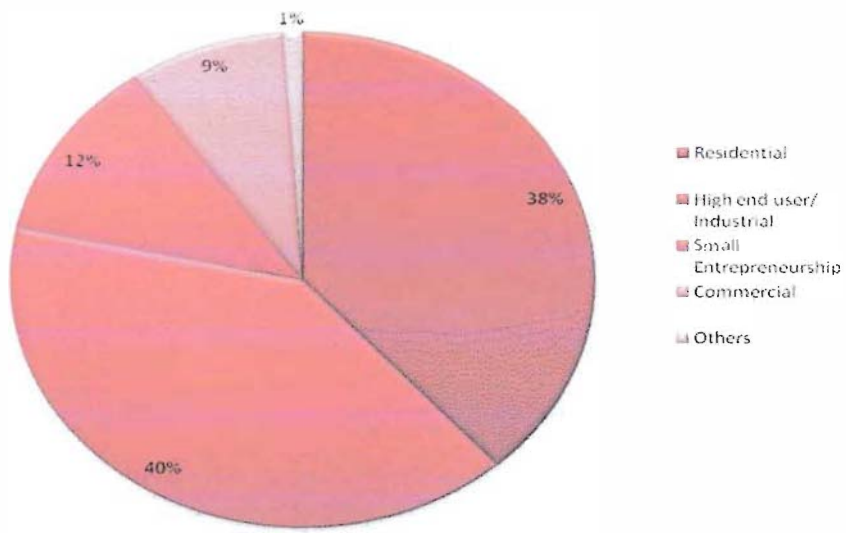


Figure 4 : (top) No. of consumer (below) Percentage of consumed electricity (up to Feb'10)

3. PROJECT PLANNING

3.1. Introduction

We have learned about planning, project and development from Project Planning Department of DPDC (Room no- 1213), Biddut Bhaban (11th floor), 1, Abdul Ghani Road, Dhaka -1000. Engineer Md. Mokaddas Hossain, Manager (Technical), Project Planning was our coordinator. On 15th May 2010 and 22nd May 2010 we were present there. Our schedule time was 9:00am to 5:00pm every day. We have also learned about development concept, classification and types of planning and projects, project cycle, financial, economical and technical viability of a project, project approval, evaluation and implementation.

3.2. Development

First of all we are taught about development. Our coordinator defines the development in his words where development considered as a process whereby the entire social system of a country moves upward. It is a process of a cumulative change resulting from positive forces that raise the standard of living of the common mass.

3.3. Planning

Our coordinator also explains definition of planning where he mentioned that p lanning is the process of consciously developing a sequence of future actions to achieve specified goals. To pursue the completion of successful planning it may take longer time and patience to overcome the hurdles.

3.4. Functional Classification of Planning

According to our coordinator functional classification of planning has different type of that is listed below:

- Macro Economic Planning /National Planning
- Sectoral Planning
- Micro Economic Planning/Project Planning

3.5. Types of Planning

Planning can be diversified according to property of criteria that should be followed regarding the characteristics as described by our coordinator in details. There are 6 types of planning which he mentioned:

1. Inductive planning
2. Command planning/Centralized planning
3. Planning in a mixed economy
4. Sectoral
5. Rolling plan
6. Planning in market economy

The types of planning DPDC follows are described below according to our coordinator.

3.6. Inductive Planning

In case of indicative Planning the government only indicates areas where further development is desired. The government does this through adoption of certain economic policies in the monetary and fiscal areas. This type of Planning has been taken up mainly in Japan, the U.K and the U.S.A.

3.7. Command Planning/Centralized Planning

In command planning, every single economic decision is controlled, directed and undertaken by the government i.e. by centrally controlled planning machinery.

3.8. Planning in a Mixed Economy

In mixed economies most of the third world economies are characterized by the existence of an institutional setting in which a part of the productive resources is privately owned and operated while the other part is controlled by the public sector. This type of planning is seen in Third world countries like Bangladesh, India etc.

3.9. Sectoral : Planning Program/Regional Planning

Sectoral planning is prepared within the overall framework of the National plan keeping view of the national objectives, goals and priorities. The nation is to be divided into meaningful economic regions and sub-regions on the basis of economic & physical characteristics of its various components. The characteristics of production, marketing and distribution channels, transport modes, river system, physical features etc. influence the formation of these viable economic regions. Each region will have to undertake planning for its socio-economic development. Regional planning has been essential for comprehensive rural development as well as balanced regional growth with meaningful dispersion of industries cash crops and other economic activities. The national plan provides allocation to regional boards to undertake program of their own.

3.10. Rolling Plans

A rolling plan is revised the end of each year and as the first year of the plan is dropped, estimates, targets and projects for another year are added to the last year. Most of the DPDC's planning is rolling plan based.

3.11. Planning in a Market Economy

Government has a stake in shaping its economy. It must provide direction formulate policies, initiate reform process, mobilize public support in favor of wide range of change, in order to build up confidence of the private sectors to act and operate freely.

3.12. Durational Classification of Planning

According to our coordinator a planning can be continuing for a month to several years in DPDC. According to duration of time spend planning may be classified as listed below:

- Long-Term/Perspective Planning (15/20 Years)
- Medium-Term Planning (Five-Year Plan)
- Short-Term Planning /Annual Development Plan (One-Year)

3.13. Plans and Project

Two combine the ideas of plans and project our coordinator discussed in detail which are mentioned below:

Plans and projects are the two most important instruments of achieving development goals in Bangladesh. The Government of Bangladesh desires to achieve simultaneously a number of economic and social objectives e.g. raising standard of living, raising per capita income, self-sufficiency, rapid industrialization and creating employment opportunity etc. For free market system needs some kind of planning in order to achieve these desired objectives. In DPDC according to time factor, plans are divided into Medium term plans and short-term plans. Medium term plans are important part of the planning and during the periods some investment is intended to show results. Short term plans are drawn up in conjunction with the estimates of the budget and both form an obligation for the government.

It is obvious that plans require a great deal of research. The pre-investment studies provide the basis for the project formulation in a planned economy. The perspective plans ultimately boil down to disaggregated projects.

3.14. Classification of Projects

Projects may be classified in numerous ways depending upon the criterion of classification. It can be divided according to (a) source of financing (aided/ non-aided); (b) Timing of inclusion (ongoing/ new); (c) according to ownership (public/ private) etc. Other criteria also mentioned by our coordinator also.

Type "X": Self-financing projects i.e. projects, which earn revenue through sale of output (goods and services). These may be called directly productive projects. Notable example of this type of projects is project of industrial sectors. Investment worth of such projects can be determined through cost-benefit analysis.

Type "Y": Productive but non-revenue earning projects which give rise to tangible output, benefit of which do not accrue directly to projects themselves but to other parties. Notable examples are irrigation projects. These projects can be subjected also according to cost-benefit analysis.

Type "Z": Service sector projects i.e. projects, which do not give rise to tangible output but provide service benefits to the society. The benefits of such projects cannot be quantified in monetary terms. Example of this type is our educational sectors.

3.15. The Project Cycle

Before we can begin our discussion on project cycle, we must have a clear idea of what a project is. Mr. Mokaddas Hossain gave us a overview of project cycle during discussion of project. A project may be defined as an optimum set of investment activities based on comprehensive and sectoral planning, by means of which a defined combination of human and material resources is expected to cause a determined amount of social and economic development within a specified period of time. So it is an activity on which we will spend money in expectation of returns and which logically seems to lend itself to planning, financing and implementing as a unit. It is the smallest operational element prepared and implemented as a separate entity in a national plan or program. It is a specific activity with a specific starting and a specific ending point intended to accomplish a specific objective.

3.16. Activities of the Project Cycle

Mr. Mokaddas gave us a brief discussion on project cycle and its activities, which is mentioned in the following paragraphs. He also provided us an organogram to show the chain steps of project cycle.

Project activities take place in several distinct stages. These stages are commonly referred to as the "project cycle." The project cycle, as such, refers to steps or stages that a project undergoes from the time when it is only an idea to the time it is completed and followed up. Different terms can be used

to describe the various stages of the project cycle. The Word Bank uses the following as also shown in Fig. 5:

- Identification
- Preparation & Analysis
- Appraisal
- Approval
- Implementation
- Evaluation

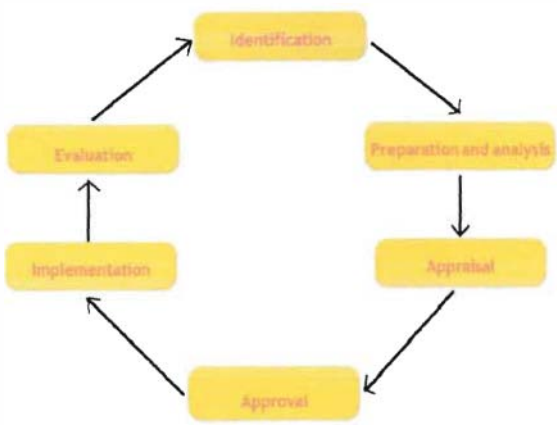


Figure 5 : Project Cycle

In case of large and foreign aided projects, all the steps are followed rigorously. In cases of small locally financed projects all steps are, of course, followed but less rigorously. The stages of project cycle are depicted in the following:

- Gather information about the National Plan
- Assess the relative importance of sectors covered in the National Plan.
- Measure the importance of various projects in a sector.
- Prioritize projects according to importance.
- Select the project.
- Set-up the objective of the project.
- Collect data on the technical, economic, commercial, financial, managerial and organizational aspects of the project.
- Determine alternative ways to do the project.
- Finalize preliminary feasibility studies and reports.
- Preparation of Development Project Proforma (DPP)
- Appraise the soundness of the project in technical, economic, commercial, financial, managerial and organization terms.
- Agree upon a loan document.
- Process the project proposal through competent authorities for approval.

- Manage procurement process.
- Award contracts.
- Implement the project according to schedule.
- Monitor the project's progress.
- Adapt the project to changing circumstances.
- Suggest method which will help for future prospect of similar nature.

4. DESIGN – 1

4.1. Introduction

We have learned about preparing MOD (Monthly Operational Data), system loss minimization strategy, support services and executive summery from Design 1 Department of DPDC (Room no-1214), Biddut Bhaban (11th floor), 1, Abdul Ghani Road, Dhaka -1000. Engineer A.S.M. Hafizur Rahman, Manager (Technical), Design-1 was our coordinator. On 29th May 2010 and 5th June 2010 we were present there. Our schedule time was 9:00am to 5:00pm every day.

4.2. Preparing a Monthly Operational Data (MOD)

Mr. Hafiz gave us a brief idea about MOD. He told that there is a combined meeting held during the first week of the month regarding over all electricity situation, monthly functional activities (both technical & non-technical). Administrative audits, Disciplinary rule, Recruitment are discussed also. The MOD shall be prepared by the middle of the month by collecting data from 32 NOCS (Network Operation Customer Service). There are north zone and south zone. Each zone consists of 16 NOCS. Each NOCS govern by a Manager. Four NOCS combined by a DGM (Deputy General Manager) and Under a GM (General Manager) there are four DGM.

4.3. Reporting

According to our coordinator, DPDC reports to the parliament through the Ministry of Power, Energy & Mineral Resources. A committee is made to report after analysis of the Monthly operated data. They report first to the secretarial board. After that the secretary presents the summarize report to the Minister.

4.4. Commercial Operation

The commercial operation is discussed my Mr. Hafiz. He told that DPDC buy energy from BPDB and sells it to the consumer of Dhaka city. They try to collect maximum amount of bill paid by the consumer to make maximum profit and minimum loss. The main purpose of running a company like DPDC is to make it profitable company by collecting revenue at rate of 100%. The following list is the Commercial operation of DPDC (Fiscal year 2009-2010 and up to February 2010):

- Total Imported unit – 369.87 crore unit
- Total Billed unit – 321.51 crore unit
- Amount of monthly average bill – 160.01 crore unit
- Amount of monthly average collected bill – 160.02 crore unit
- Amount of monthly average system loss – 13.07 % (at 132 KV level)

- Amount of monthly average system loss – 12.34 % (at 33 KV level)
- Average Billing rate – 3.85 taka per unit
- DPDC buy electricity of different voltage levels at 42 points from PDB.
- DPDC buy Almost 23 % of electricity from PDB.

4.5. System Loss

Our coordinator discussed about electrical system loss and also its demerits. According to his discussion system loss is one the most important parameters for measuring the performance of the distribution. It is the percentage change in the energy sales and energy purchase. Starting from the inception, DPDC is showing constant improvement in reducing system loss. On July 2008 DPDC started its journey with 22.89% system loss. In the fiscal year 2009-2010, system loss target was 17% in 132 KV level and 15.5% in 33KV level. Up to February 12.34 % system loss achieved in 33 KV level.

4.6. Suggestions to Reduce System Loss

DPDC has suggested several steps to reduce the system losses that are listed below:

- Turn off your home office equipment when not in use. A computer that runs 24 hours a day, for instance, uses - more power than an energy-efficient refrigerator.
- If your computer must be left on, turn off the monitor; this device alone uses more than half the system's energy.
- Setting computers, monitors, and copiers to use sleep-mode when not in use helps cut energy costs by approximately 40%.
- Battery chargers, such as those for laptops, cell phones and digital cameras, draw power whenever they are plugged in and are very inefficient. Pull the plug and save energy.
- Screen savers save computer screens, not energy. Start-ups and shutdowns do not use any extra energy, nor are they hard on your computer components. In fact, shutting computers down when you are finished using them actually reduces system wear and saves energy.
- One of the best energy-saving devices is the light switch. Turn off lights when not required.
- Use Electronic ballast instead of magnetic ballast.
- Fluorescent tube lights and CFLs convert electricity to visible light up to 5 times more efficiently than ordinary bulbs and thus save about 70% of electricity for the same lighting levels.

- By reducing the temperature setting of water heater from 60 degrees to 50 degrees C, one could save over 18 percent of the energy used at the higher setting.
- Use an electric kettle to heat water. It's more energy efficient than using an electric cook top element.
- Iron your clothes and linen all in one go. Do not keep a hot iron which is switched in an upright position for long period since more heat will be lost.
- Avoid storing hot / warm food in the refrigerator.
- By locating doors and windows to admit more sunlight through them you can avoid using electricity for lighting your home or office during the day.
- Auto defrost refrigerators consume more electricity. Larger the refrigerator, higher will be the usage of electricity.

4.7. Support Services for Consumer

Our coordinator talked about some services taken by DPDC for their consumers. DPDC's NOCS (Network Operation Customer Service) had taken zero tolerance policy against corruption. It introduced CSS (Commercial Support Service) and DSS (Distribution Support Service).

There are total 32 NOCS of DPDC. Under Commercial Support Service (CSS) there are 8 NOCS units of 32 NOCS units doing outsourcing by taking meter reading. Under Distribution Support Service (DSS) there are 8 NOCS units of 32 NOCS units doing outsourcing by performing technical fault maintenance.

To save electricity inspirational project are accelerated among customers. Under the project named "Technical & Equipment Support for Energy Saving in DPDC Area" Distribution of Energy saving bulb and electronic ballast has been completed in Rajarbag and Gulbag area. These projects help not only in Load Demand Management but also in Low carbon emission under CDM (Clean development Mechanism) governing by UN.

4.8. Executive Summary

According to our coordinator Design 1 department's main work is to make executive summary. An executive summary is term used in business for a short document or table that summarizes a longer report, proposal or group of related reports in such a way that readers can rapidly become acquainted with a large body of material without having to read it all. It will usually contain a brief statement of the problem of proposal covered in the major documents, background statement, concise analysis and main conclusion. It is intended as an aid to decision making by business manager. Following Table 4 is the executive summary of energy consumption and Load shedding of DPDC for the month of March, 2010 shows below:

	Import from BPDB (MKWh)	Import at 33 kV Level (MKWh)	Sale (MKWh)	Maximum Load Shedding (MW)		Maximum Received (MW)		Average Monthly Load Shedding (MW)		Maximum Syst Demand (MW	
				Day Peak	Eve. Peak	Day Peak	Eve. Peak	Day Peak	Eve. Peak	Day Peak	Eve. Peak
ring	484.011	481.646	408.394	333.24	499.09	698.77	738.95	177.44	335.89	989.07	1138.
ous	372.832	369.831	337.213	149.98	276.64	675.80	675.66	67.09	212.39	785.06	915.5
spo of	445.086	440.876	353.801	412.60		645.30		309.58		992.9	

Table 4: Energy Import, sales and Demand

DPDC provides a monthly summary of system loss in different parts of the system. It provides loss information based on geographical location and also on transmission loss at different voltages level. The system losses at different level are listed below in Table 5:

	System loss as Percentage of Energy Import at 132 kV (%)	: 15.62 %
	System loss at 33 kV (%)	: 15.21 %
	System loss at 33 kV, GM North (%)	: 14.34%
	System loss at 33 kV, GM South (%)	: 16.00 %
	Transmission Loss (%) (Diff. bet. 132 kV import (as billing on BPDB) & 33 kV import)	: 0.49%

Table 5: System Loss

DPDC has different types of consumer like domestic, industrial, commercial and social serv sector. All the bought energy from BPDB is distributed among these consumers. The category w energy consumption is listed below in Table 6:

Categories of customers	Energy sales (MKWh)	Total Sales (%)
Domestic (A)	159.319	39.01
LT Industries (C)	43.323	10.61
Commercial (E)	34.805	8.52
33 &11 kV Bulk (F&H)	166.598	40.79
Other (Irrigation (B), Mosque (D), Street Light & Water Pump (J))	4.349	1.06
Total	408.394	100.000

Table 6: Category Wise Energy Consumption

DPDC earns revenue by selling energy to the consumers. The billing amount, rate and collection gross billing are listed below in the Table 7 for the month of March 2010:

Month	No. of Customers	Gross Bill (MTK)	Gross Collection (MTK)	CI Ratio (%)	The ratio of collection to billed amount (%)	Billing Rate (Taka/KWh)
Reporting month	734165	1745.230	1557.210	78.61	92.71	4.11
Previous month	729798	1353.998	1369.770	96.06	105.36	3.86
Corresponding month of previous year	690.698	1436.653	1431.042	85.23	106.21	3.81

Table 7: No. of Customers, Billing, Collection, Ratios and Billing Rate

The different organizations like Government, private companies, other electrical companies receive bill which are listed below in Table 8:

Sector	Receivable Amount (MTK)		Equivalent Billing Month (On principal)
	Principal (MTk)	LPS (MTk)	
Govt.	380.738	349.821	7.43
Semi Govt./Autonomous	893.276	1469.127	9.08
Private	3225.657	-	2.42
DESCO	433.899	-	-
REB	186.250	-	-
Total	5119.820	-	2.93

Table 8: Account Receivable

5. SYSTEM PLANNING

5.1. Introduction

We have learned about Projection of demand, Future development, Demand management, Planning for load catering by 2021, Construction of underground cabling between substations and Ring main unit from System Planning Department of DPDC (Room no- 1202), Biddut Bhaban (11th floor), 1, Abdul Ghani Road, Dhaka -1000. Engineer Md. Mojibur Rahman, Manager (Technical), System Planning was our coordinator. On 12th June 2010 and 19th June 2010 we were present there. Our schedule time was 9:00am to 5:00pm every day.

5.2. Planning the System

The system planning department of DPDC must have all the technical and economical geographical data before planning any system as mentioned by Md. Mojibur Rahman who is our coordinator. The S/S, transmission and distributional data and the equipment present at the current system is necessary to develop the electrical system. By the load forecasting, maximum load calculation and capacity of the S/S, the system planning department renew and extend the existing S/S and also locate the suitable place for new S/S establishment. According to our coordinator the following aspects about System Planning have to be considered in an electrical system:

- Substation Capacity
- Maximum Load
- Over all view of Transmission system
- Over all view of Distribution system
- Over all view of switching station
- Over all view of RMU system
- At distribution link up with S/S to S/S (over head line and underground cable)
- Draw single line diagram of cable route line
- In case of new S/S new distribution/transmission drawing line is needed

5.3. Projection of Demand

Mr. Mujibur Rahman explained about the growth of power consumption of DPDC's consumers. Every year demand of energy is increasing because of new consumer added in the system. With the existing consumer the projection of future demand is forecasted. DPDC is considering at 8.8% annual load growth on their system. In the basis of this annual load growth DPDC forecasted its demand up to year 2021. Table 9 shows the tendency of projection demand of DPDC and Fig. 6 shows the graphical representation of the forecasted demand of DPDC.

Year	Load (MW)	Load (MVA)
2009	1138	1423
2010	1238	1548
2011	1347	1684
2012	1466	1832
2013	1595	1993
2014	1735	2169
2015	1888	2360
2016	2054	2567
2017	2234	2793
2018	2431	3039
2019	2644	3306
2020	2878	3597
2021	3131	3914

Table 9: Projection Demand of DPDC

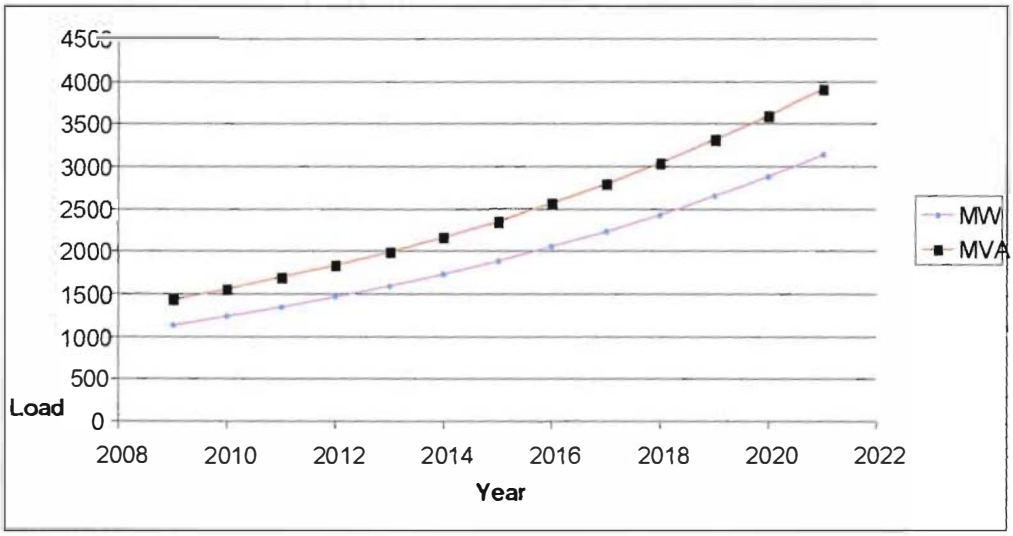


Figure 6: Demand of DPDC at 8.8% Load Growth

5.4. Future Development

To keep pace with the demand, DPDC should aware about future development as informed us by our coordinator. Every year number of consumer is increasing with 8.8% of load growth. To provide uninterrupted power supply, Future development must be undertaken. Otherwise system will be collapsed. The following aspects should be considered for future development according to our coordinator.

- Handle the present system
- Future load forecasting
- Locate place of new Substation and establishment

5.5. Demand Management

Mr. Mujibur Rahman told us that Government has a target to ensure interrupted electricity for all by the year 2021. For achieving the target DPDC has taken some initiatives and designed detail plan for demand management. The following Table 10 (load figures in MVA) shows the perspective plan demand management of DPDC for the year 2021 as predicted and analyzed by our coordinator on behalf of DPDC.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
			3 Nos. Proc. & Install.	2 No. Dev. Of New SS	1 Nos. DU Grid (PGCB)		4 Nos. Construc. & Conver.		1 Nos. Emerg. Construc.		4 Nos. Contruc.		
			225	300	240		480		240		960		
	1661	1661	1886	2186	2426	2426	2906	2906	3146	3146	4106	4106	4106
	1423	1548	1648	1832	1993	2169	2360	2567	2793	3039	3306	3597	3914
	1626	1626	1930	2211	2211	2211	2771	2771	3051	3387	3387	4059	4059
			277	308			560		280	336		672	
			10Nos. RRA+ BSCIC	6No. Dev. Of New SS			10Nos. Construc. Proposed Project		5 Nos. Emerg. Construc.	12Nos. RRA		12 Nos. consrtuc.	

Table 10: Perspective Demand Management of DPDC

5.6. Case Study: Construction of 33 kV Underground Cable

Mr. Rahman provides us a case study on DPDC's project development scheme under his authority. DPDC had completed a development work according to own funded deposit scheme of Construction of 33 KV Kamrangirchar – Zigatola double circuit U/G line from Kamrangirchar grid S/S to Zigatola 33/11 KV S/S. The steps of the procedural job description are given below:

- Before starting work, all drawing and planning is examined.
- Fig.7 shows the drawing of constructed underground cable line.
- Laying underground cable (33 kV, 3*1*1c.m.*500mm^2 XLPE) from Kamrangirchar grid S/S to Zigatola 33/11 kV S/S through BDR area.
- For cable safety R.C.C slab is installed as per drawing.
- Cable trenching is done as per drawing.
- Make straight through joint where required as per direction of Engineer-in-Charge.
- Connect the laid cable at Kamrangirchar 33 kV spare breaker as per direction of Engineer-in-Charge.
- Connect the laid cable at Zigatola 33 kV breaker with existing breaker. Open the existing source.
- In BDR area construction is done by following the condition which is attached to the job description by BDR authority and as per direction of Engineer-in-Charge.

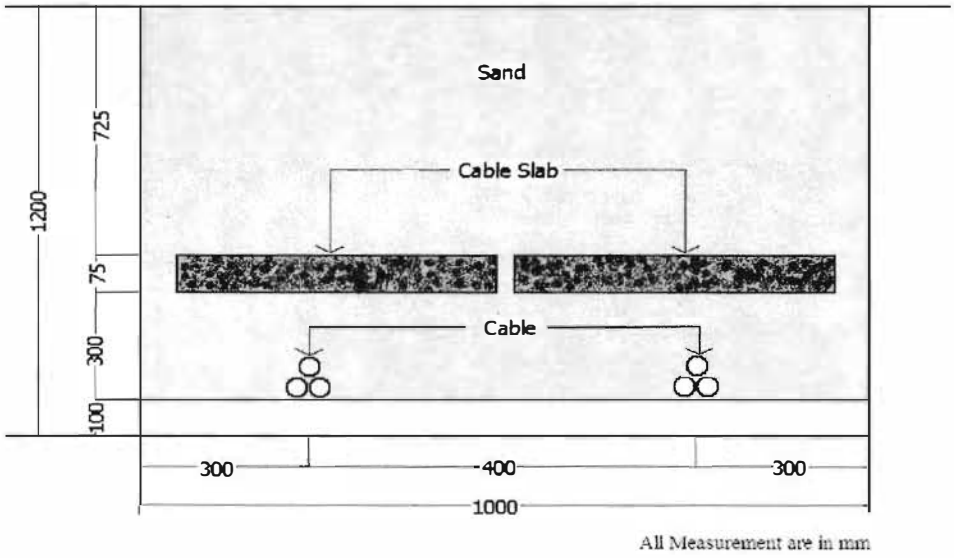


Figure 7: U/G Cable Laying and Trenching

5.7. Ring Main Unit (RMU)

Our coordinator gave us idea of new electrical equipment which is named as RMU. Ring Main Unit used at H.T. side. RMU is having 3 no. of switches (Circuit Breakers or Isolators or LBS), it is used for two inputs with mechanical or electrical interlock and one outgoing to the load. Either one input with two outgoings. RMU used for redundancy feeder's purpose. Ring main unit is used in a secondary distribution system. It is basically used for an uninterrupted power supply. Alongside, it also protects system's secondary side transformer from the occasional transient currents. Depending on system's applications and loading conditions can use a switch fuse combination or a circuit breaker to protect the transformer. This transformer connected to the switch fuse/ circuit breaker. In a common arrangement have Load break switches on both the sides of the system. Ring main Units come in standard ratings of 11/22/33 kV, 630/1250 A, 21 KA. Fig. 8 shows RMU at hotel Sonargaon.

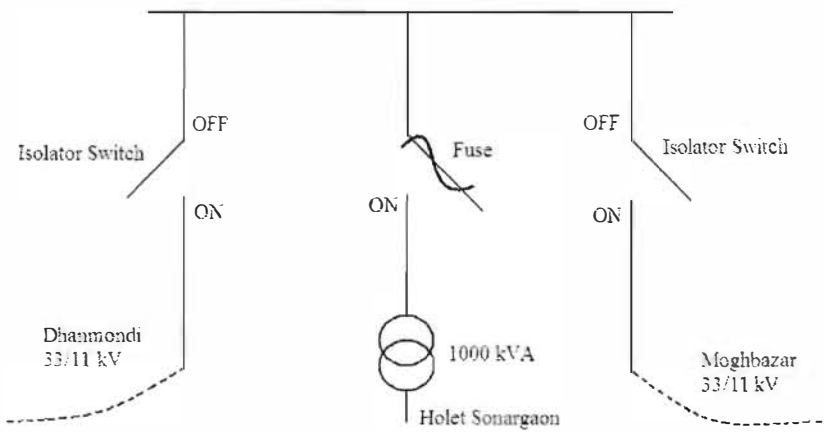


Figure 8: RMU at Hotel Sonargaon

6. POLICY STANDARDS AND DOCUMENTATION

6.1. Introduction

We have learned about how to deal with tender preparation guideline, conditions for Tenderer Forms of tender etc. from Policy Standard & Documentation Department of DPDC (Room no 1212), Biddut Bhaban (11th floor), 1, Abdul Ghani Road, Dhaka -1000. Engineer Md. Sarwar-e Kainat Mohammad, Deputy Manager (Technical), Policy Standard & Documentation was ou coordinator. On 26th June 2010 and 3rd July 2010 we were present there. Our schedule time wa 9:00am to 5:00pm every day.

6.2. Function of Policy, Standard and Documentation Department

Mr. Sarwar discussed the activities of his department to us. The department of Policy, Standard an Documentation has some core functional activities which are given below:

- Determining price of tender document (Revenue budget and development sector of DPDC)
- Preparation of tender document (Revenue budget and development sector of DPDC)
- Preparing Evaluation Report of Tender document
- Approving design and drawing of equipments and machinery of tender document
- Approval report by the visiting technical committee of pre-supplied goods and equipments
- Guideline according to the PPR (Public Procurement Regulation)

6.3. Tender Preparation Guideline

Tender is a vast area to describe but our coordinator provide us systematic steps to learn about th Tender process. To prepare a Complete Tender for Tenderer the following instructions are followed The detailed instruction contains all criteria for Tenderer to submit a complete report to purchaser.

6.4. Instruction to Tenderer

6.4.1. General

There are general instructions in tender process described by our coordinator. He provides us formal written instruction regarding instruction to Tenderer. He told us of various facts for tende process which are summarize below in simplex ways.

Scope of Tender

The Purchaser issues Tender document for the supply of goods and related services according to th Tender document for the Supplier, Where Schedule of requirements, the name of the Tender, Th number and identification of its constituent lot are stated.

Source of Funds

The fund may have financial support from DPDC's internal and other external sources. T purchaser intends to apply a portion of DPDC's own funds allocated for procurement of goods a services to eligible payments under the contract for which this tender document is issued.

Corrupt, Fraudulent, Collusive or Coercive Practices

A tender should be a non- corrupted process. No outer influences should act upon on this. T purchaser, Tenderers and Suppliers shall observe the highest standard of ethics during implementation of procurement proceedings and the execution of contracts under the alloca funds.

Corrupt practices means offering, giving, or promising to give, directly or indirectly to any officer employee a procuring entity, a gratuity in any form. Fraudulent practices means a misrepresentat or omission of facts in order to influence a procurement proceeding.

A collusive practice means a scheme of arrangement among two or more Tenderers, with or with the knowledge of the purchaser by illegal act of changing tender prices. Coercive practices mea harming or giving threat, directly or indirectly to persons or their property to influence t e ten process.

Eligible Tenderers

An eligible Tenderer has some requirement to take part in a tender process. Otherwise it may consider as a disqualification. Invitation of tender is open for all countries except countr prohibited by the Government of Bangladesh for business in Bangladesh. A Tenderer may b physical or juridical individual or body of individuals or company or joint venture or consortium association or any combination of them. A government owned enterprise in Bangladesh may a participate in the Tender if it is legally and financially autonomous. The Tenderer shall not insolvent, be in receivership, be bankrupt or being wound up, its business activities shall not suspended. The Tenderer shall have fulfilled its obligations to pay taxes and social secur contributions under the relevant national laws and regulations.

Eligible Goods and Related Services

All goods and related services are eligible unless their origin is from a country prohibited by Government of Bangladesh for business in Bangladesh. Origin means the place where t e goods mined, grown or produced or the place from which the related services are supplied.

Site Visit

Requiring of installation, commissioning, and networking of goods are established at the s Tenderer is encouraged to visit and examine t e site and obtain all information that may necessary for preparing the tender. The Tenderer should ensure that the Purchaser is informed of visit in adequate time to allow it to make appropriate arrangements. The cost of visiting t e site sh be at the tenderer's own expense.

6.4.2. Tender Document

Mr. Sarwar also discussed about tender document process. All these are rewritten in our words to describe for the readers of this intern report. The following paragraph shall explain tender documents efficiently.

Clarification

A Tenderer requiring any clarification of the tender document shall contact the purchaser in writing at the purchaser's address indicated in the TDS. The purchaser will respond in writing no later than seven days prior to the deadline for submission of tenders. The purchaser shall forward copies of its response to all those who have purchased the tender document, including a description of the inquiry but without identifying its source.

Pre-Tender Meeting

To clarify issues and to answer questions on any mater arising in the tender document, the purchaser may invite prospective Tenderer to a pre-tender meeting. Non-attendance at the pre-tender meeting will not be a cause for disqualification of a tender.

Amendment

Any amendment issued shall become an integral part of the tender document and shall be communicated in writing to all those who have purchased the tender document.

6.4.3. Qualification Criteria

According to Mr. Sarwar qualifications are essential for a Tenderer to apply for a tender process. It may be general, experience and financial.

General Criteria

The Tenderers shall posses the necessary professional and technical qualification and competence, financial resources, production capability with equipment and other physical facilities, including after-sales service where appropriate, managerial capability, specific experience, reputation and the personnel to perform contract.

Experience Criteria

A minimum number of years of overall supply experience is required. Specific experience as stated in the tender data sheet is required. The manufacturers have a minimum production capability or availability of equipment. A Tenderer shall have valid dealership/ distributor/ agency certificate.

Financial Criteria

The Tenderer shall have some minimum level of financial capability. The satisfactory completion of supply contract of number, nature and value within a specified period as stated in the tender data sheet. Availability of minimum liquid assets or working capital or credit facilities from a Bank as stated in the tender data sheet.

6.4.4. Tender Preparation

Tender preparation is a complex process as described by our coordinator. But it is not difficult if we follow prescribed steps according to the requirement. The following paragraphs will explain tender preparation easily.

Single tender submission

A Tenderer shall submit only one Tender for each lot, either individually or in a combination. More than one submission will reject Tenderers participation.

Preparation Costs

The Tenderer shall bear all costs associated with the preparation and submission of its tender.

Language

The tender, as well as all correspondence and documents relating to the tender shall be written in the English language. Supporting documents and printed literature furnished by the tenderer may be in another language e.g. Bangla language.

Contents of Tender

The tender prepared by the Tenderer have separate Technical proposal and financial proposal.

Technical proposal shall contain following:

- The tender submission sheet
- Tender security documentation
- Specification submission sheet
- Written confirmation authorizing the signatory of the tender to commit the Tenderer
- Documentary evidence establishing the tenderer's eligibility to tender, the manufacturer's authorization in the form of letter or their certificate authenticating them as dealer/ distributor/ agency
- Documentary evidence that the goods and related services are of eligible origin and establishing the tenderer's qualifications to perform the contract.

Financial proposal shall contain following:

- The completed price proposal sheet
- The completed price schedule
- Submission Sheet, Price Schedules and Specifications Submission Sheet

All the documents shall be completed without any alternations to their format, filling in all blank spaces with the information requested, failing which the tender may be rejected as being non-responsive. If the Tenderer has made error prior to submission of its tender, a statement shall be made as to the total number of each corrections made, at the end of the price schedule.

Alternatives

Alternative tenders shall not be considered. Unique and single tender is applicable for a spec tender submission.

Prices and Discounts

For all items and quantities for each lot, Schedule of requirement must be listed and pri separately on the price schedule. Prices quoted shall correspond to 100% of the items and quanti specified for each lot. The Tenderer shall indicate the unit price as well as total price. Pr indicated shall include some required information. The price of goods and related services, includ all applicable duties, sales and other taxes, VAT etc already paid or payable on the goods and rela services, the price for inland transportation, insurance and other local costs incidental to delivery the goods to their final destination. Prices quoted by the Tenderer shall be fixed during the tender performance of the contract and not subject to variation on any account.

Currency

All prices shall be quoted in Bangladeshi taka.

Documents Establishing Eligibility (Tenderer)

The Tenderer shall submit documentary evidence to establish its eligibility.

Documents Establishing Eligibility (Goods and Related Services)

The documentary evidence may be in the form of literature, drawings or data, and shall consist detailed item by item description of the essential technical and performance characteristics of goods and related services, demonstrating the substantial responsiveness of the goods and rela services to those requirements of technical specification. The tenderer shall note that standards workmanship, material, and equipment as well as references to brand names or catalog numb designated by the Purchaser in its technical specification, are intended to be descriptive only and restrictive. The Tenderer shall also furnish a list giving full particulars, including available sour and current prices of spare parts, special tools etc.

Documents Establishing Qualifications (Tenderers)

Tenderer shall include the following information and documents with their technical propo regarding qualification establishment:

Total monetary value of supply contracts for each of the years.

Details of major supply contracts over the year and list of clients who may be contracted for furt information on these contracts

Financial report or balance sheets or profit and loss statements or auditor's reports or bank referen with documents or a combination of these demonstrating the availability of liquid assets successfully complete the award.

Authority to seek references from the tenderer's Bankers

Information on past 5 years in which the Tenderer has been involved or in which the Tender currently involved

If the tender is submitted jointly then the following information should be required:

The Tenderer shall include all the information listed for each JVCA (Joint Venture Consortiu Association) member.

The tender should be signed so as to be legally binding on all members.

All members shall be jointly and severally liable for the execution of the contract in accordance the contract terms.

One of the members will be nominated as being in charge, authorized to take liabilities and rec instructions for and on behalf of any and all members of JVCA (Joint Venture Consortiu Association).

The execution of the entire contract, including payment shall be done exclusively with the mer in charge.

Disqualification (Tenderer)

The purchaser shall disqualify a Tenderer who submits a document containing false informatio purposes of qualification or misleads or makes false representation in proving its qualifica requirements. The purchaser may disqualify a Tenderer who has a record of poor performance, as abandoning the supply, not properly completing the contract, inordinate delays, litigation his or financial failures.

Validity

Tender shall remain valid for the period specified in TDS after the date of tender submis prescribed by the purchaser. In exceptional circumstances, prior to the expiration of the te validity period an extension of validity period may be done and the request and the responses be made in writing.

Security

The tender security includes the following conditions:

The tenderer's financial security options is either in the form of a bank or pay order or else i form of an irrevocable bank guarantee issued by a scheduled bank of Bangladesh.

It shall be payable promptly upon written demand by the purchaser.

It shall be remain valid for a period of 28 days beyond the original validity period of tende beyond any period of extension.

Unsuccessful tenderer's tender security will be discharged or returned within 28 days of the en the tender validity period.

The tender security may be forfeited because of some reasons. If a Tenderer withdraws its tender during the period of tender validity the tender shall be invalid. If the successful Tenderer fails to accept the correction of its tender price or fails to furnish a performance security or fails to sign the contract.

Tender Format and Signing

The technical and financial proposal both shall be submitted in one original and in number of copies as specified in the TDS and clearly mark each of them "Original : Technical proposal" and "Copy : Technical proposal" ; "Original : Financial proposal" and "Copy : Financial proposal" respectively.

The original and each copy of the tender shall be typed or written in indelible ink and shall be signed by the person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written authorization and shall be attached to the Tenderer information sheet. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the original and of each copy of the tender, except for un-amended printed literature, shall be numbered sequentially and signed by the person signing the tender. Any interlinings, erasures or overwriting shall be valid only if they are signed by the person signing the tender.

6.4.5. Tender Submission

To submit a tender some process shall be followed. There are some formal way and process that should be done strictly as described by Mr. Sarwar. Following paragraphs will explain and concern some important tender submission process.

Sealing and Marking of tender envelope

The Tenderer shall enclose the original and all copies of Technical and Financial proposal in two separate single envelopes, duly marking the same as "Technical proposal" and "Financial proposal" respectively. The envelope should contain following:

- Bear the name and address of the Tenderer
- Be addressed to the Purchaser at the address specified in The TDS.
- Bear the name of the tender and the tender number as specified in the TDS.
- The envelope containing the Technical proposal shall also bear a statement on the envelope "DO NOT OPEN BEFORE ----------", time and date for Technical proposal opening as specified in TDS.
- The envelope containing the financial proposal shall also bear a statement on the envelope "NOT TO BE OPENED DURING TECHNICAL PROPOSAL OPENING".
- If all the envelopes are not sealed and marked, the purchaser will assume no responsibility for the misplacement or premature opening of the tender.

Submission Deadline of tender

Tender must be received by the purchaser at the address no later than the date and time specified in the TDS. Tenders may be hand delivered, posted by registered mail or sent by courier. The purchaser shall, on request, provide the Tenderer with a receipt showing the date and time when its tender was received.

Late Submission of a tender

Any tender received by the purchaser after the deadline for submission of tenders shall be declared late, will be rejected, and returned unopened to the Tenderer.

Modification, substitution and Withdrawal of tender

A Tenderer may modify, substitute or withdraw its tender after it has been submitted by sending a written notice, duly signed by the same authorized representative and shall include a copy of the authorization. No tender shall be modified, substituted or withdrawn after the deadline for the submission of tenders.

6.4.6. Tender Opening and Evaluation

Opening a tender

The purchaser shall open the envelope containing Technical proposal of tenders in public, including modification or substitutions at the time, on the date and at the place specified in the TDS. Tenderers or their authorized representatives shall be allowed to attend and witness the opening of technical proposal and shall sign a register evidencing their attendance.

The appropriate name of the Tenderer, tender withdrawals and modifications or substitutions on technical proposal shall be read out aloud and recorded. The sealed envelope containing financial proposal shall not be opened at that time but recorded and read out aloud and initialed by a minimum of three members of the purchaser's tender opening committee.

The purchaser shall open the envelope containing financial proposal in public of the Tenderers who submitted substantially responsive technical proposal at the time of technical proposal opening. The others formalities should be done similarly stated about technical proposal event.
No tenders shall be rejected at the tender opening except for late tenders.

Confidentiality a tender

After the opening of tenders, information relating to the examination, clarification and evaluation of tenders and recommendations for award shall not be disclosed to tenderers or others persons not officially concerned with the evaluation process until after the award of the contract is announced.

Clarification of tender

The purchaser may ask Tenderers for clarification of their tenders in order to facilitate examination and evaluation of tenders. The request for clarification and response shall be in writi Any changes in prices shall not be sought, offer or permitted, except to confirm the correction arithmetical errors discovered by the purchaser in the evaluation of the tenders.

Contacting the Purchaser (Tenderer)

Following the opening of the technical proposal and until the contract is signed no tender shall ma any unsolicited communication to the purchaser. Any effort by a tenderer to influence the purcha may result in the rejection of its tender. From the time of tender opening to the time of contr award if any Tenderer wishes to contact the purchaser, it should be done in writing.

Responsiveness of tender

A substantially responsive tender is one that conforms in all respects to the requirements of tender document without material deviation, reservation or omission.

Non-conformities, Errors and Omissions

In a substantially responsive tender, A purchaser may request that the Tenderer submits necessary information or documentation, within a reasonable period of time, to rectify non-mater non-conformities or omissions in the tender related to documentation requirements. Such omiss shall not be related to any aspect of the price of the tender.

Correction of arithmetical Errors

The correction of errors is done when there is a discrepancy between the unit price and the to price, if there is an error in a total price corresponding to the addition or subtraction of subtotals there is a discrepancy between words and figures. Any arithmetical error shall be immediat notified to the concerned Tenderer. Any Tenderer that does not accept the correction of errors, tender shall be disqualified and its tender security may be forfeited.

Tender Examination

The purchaser shall examine the tenders to determine the completeness of each document submitte The purchaser shall evaluate the technical aspects of the tender to confirm that all requireme specified have been met without any material deviation or reservation.

Evaluation of Financial Proposal

The purchaser shall evaluate the financial aspects of each the tender to confirm that all requireme specified have been met without any cost deviation.

Negotiation with Tenderer

No negotiation shall be held with the lowest or any other Tenderer. It may be declared as unauthorized activity.

Comparison of Tenderer

The purchaser shall compare all substantially responsive financial proposals to determine the lowest evaluated tender.

Post-Qualification (Tenderer)

The affirmative tender satisfaction shall be based upon an examination of the documentary evidence of the Tenderers qualification submitted by the Tenderer.

Purchaser's Right to accept or to reject any or All (Tenders)

The purchaser reserves the right to accept or reject any or all tenders, at any time prior to contract award, without any liability or obligation to inform Tenderers for the purchaser's action.

6.4.7. Contract Award

Award Criteria of tender

The purchaser shall award the contract to the Tenderer whose offer is substantially responsive to the tender document and that has been determined to be the lowest evaluated tender provided that the Tenderer is determined to be qualified to perform the contract satisfactorily.

Purchaser's Right to Vary Quantities

The purchaser reserves the right at the time of contract award to increase or decrease the quantity, per item, of goods and related services originally specified, provided that does not exceed the percentages indicated in the TDS and without any changes in the unit prices or other terms and conditions of the tender and the tender document.

Notification of Award of tender

Prior to the expiration of the period of tender validity, the purchaser shall notify the successful Tenderer, in writing that it's tender has been accepted.

Performance Security of tender

Within 14 days of the receipt of notification of award from the purchaser, the successful Tenderer shall furnish performance security for the due performance of the contract in the amount specified in the TDS.

The performance security shall be valid until a date 28 days after the date of completion of supplier's performance obligations under the contract including any warranty obligations.

Signing

The purchaser shall send the contract agreement and all documents forming the contract to successful Tenderer. Within 28 days of receipt of the contract agreement, the successful Tende shall sign, date and return it to the purchaser. Immediately upon receipt of the signed cont agreement and performance security from the successful Tenderer, the purchaser shall discharge returned the successful tenderer's tender security.

Advising Unsuccessful Tenderers

Upon the successful tenderer furnishing and signing the contract, the purchaser shall notify all o Tenderers that their tenders have been unsuccessful.

Right to Complain for Tenderer

Any Tenderer has the right to complain it it has suffered or may suffer loss or damage due t breach of duty imposed on the employer by DPDC board. The complaints shall be written submitted to the immediate higher authority for unsatisfactory decision of the employed purcha board.

Late submission of tenders

The following cases are responsible for a late submission of tenders:

- Failure to submit tender submission sheet as per tender requirement
- Failure to submit tender security as per tender requirement
- Non-compliance with requirement of validity of tender
- Failure to quote tender price as per tender requirement
- Non- fulfillment of financial obligations
- Non- compliance with delivery schedule
- Failure to meet the qualification criteria
- Incomplete submission of specification submission sheet and Tenderer information sh duly signed.
- Tender not signed or submitted by duly authorized person.

6.5. Particular Conditions of Contract

In case of particular condition of contract the following criteria are followed:

- The nature of goods to be supplied
- Name of the supplier
- Routine correspondence between parties may be in English or Bangla.
- The purchaser's and supplier's contact detail

A complete packing list indicating the content of each package shall be enclosed in a water p envelope and shall be secured to the outside of the packing case. Each package shall be marked indelible ink in bold letters as follows:

a. Contract number
b. Name and address of purchaser
c. Country of origin
d. Gross weight
e. Net weight
f. Package number of total number of packages
g. Brief description of the content

Proper monogram and environmentally neutral packing material shall be used. The documents t provided are as follows:

- Copies of supplier's invoice showing goods description, quantity, unit price, total amount
- Manufacturer's or supplier's warranty certificate
- Inspection certificate issued by the nominated inspection agency or supplier's fac inspection report

Certificate of origin for Tenderers

The prices charged for the goods delivered and the related services to be performed shall be fixed the duration of the contact. The method and conditions of payment e.g. pay cheque should be n in Bangladeshi taka. No advanced payment will be given. On delivery and acceptance, 95% of contract price of the goods delivered shall be paid upon submission of documents within 28 day the acceptance certificate issued by the purchaser. "All risks" insurance, including "war risks, and strikes" shall be acquired for 110% of the delivered cost of the goods on "warehous warehouse basis". The period of validity of the warranty shall be one year. The period for repa replacement shall be 60 days after delivery.

6.5.1. Tender and Contract Forms

A tender report has several documents and forms for supporting the tender process. Usually th organization provides the essential forms for Tenderers for apply. There are many tender an contract forms in a tender process. They are:

Tender Forms

Tender documents have several written tender Forms to accomplish the process of tendering. Tend Submission Sheet, Price Schedule, Specifications Submission Sheet, Tenderer Information She Manufacturer's Authorization Letter (where applicable), Bank Guarantee for Tender Security, Pric Proposal Sheet. They are given below:

Form G-1: Tender Submission Sheet

It is a formal letter to the purchaser from Tenderer that the Tenderer will agree to follow all th conditions and instructions of whole tender process.

Form G-2: Price Schedule

Price schedule of goods and related services are specified in tabulated form containing item numbe Description of item, Unit of supply, Quantity of unit's required, previous market price of a unit, tot previous market price, and extra price to deliver the goods to final destination, total price delivered.

Form G-3: Specifications Submission Sheet

It is a totally technical specification of goods. For example electronic meter is the item. S manufacturer's name, model, con ection process, rated frequency, voltages, currents, operatin condition e.g. temperature, height, accuracy range, display unit, battery life, weight, calibration e are mentioned in detailed.

Form G-4: Tenderer Information Sheet

Here, general information of Tenderer, qualification information of the Tenderer, financi information of Tenderer are mentioned for either individual or joint venture Tenderer.

Form G-5: Manufacturer's Authorization Letter (where applicable)

It is a formal authorization letter to the purchaser from manufacturer for authorization to perform tender process for Tenderer.

Form G-6: Bank Guarantee for Tender Security

It is a letter issued by a scheduled bank of Bangladesh for the bank guarantee of a Tenderer to the purchaser confirming the tender guarantee.

Form G-10: Price Proposal Sheet

It is a price proposal to the purchaser from Tenderer to perform a tender process before the tender process for ensuring the acceptance of tenderer's financial proposal.

Contract Forms

Contact forms are applicable for Tenderers from Purchaser. It consists of Notification of award and contact agreement.

Form G-7: Notification of Award

It is a proposal letter to the Tenderer from procuring entity to an official pre acceptance of their tender proposal as unofficial contract award as it is not sure that the Tenderer may accept it or not.

Form G-8: Contract Agreement

After a contract is awarded then a contract agreement shall be written. The following documents shall be interpreted in the order of priority below:

The signed form of contract agreement

- The letter of notification of award
- The completed tender submission sheet as submitted by the Tenderer
- The completed price schedules as submitted by the Tenderer
- The particular conditions of contract
- The general conditions of contract
- The schedule of requirements
- The technical specification
- Any other document listed in the particular conditions of contract

The purchaser, suppliers and their witnesses will sign at the contract agreement.

Form G-9: Bank Guarantee for Performance Security

It is a bank guarantee letter to the purchaser from a scheduled bank of Bangladesh at the request of supplier for the performance security.

6.5.2. Schedule of Requirements

After completing price schedule, the Tenderer shall quote prices for each item separately. List o goods, related services and delivery schedule are mentioned here. In a tabulated form item number description of items, unit of supply, Quantity of units required, point of delivery, date required ar specified.

6.5.3. Technical Specification

The technical specification covers the design, engineering, manufacture, assembly, inspection testing at manufacturer's works before dispatch, supply and delivery of class 1 accuracy. It is not th intent to specify completely herein all the details of the design and construction of material. The material shall, however, confirm in all respects to high standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manne acceptable to the purchaser. The device shall conform to the IEC (International Electro technica Commission) standard for its service condition. The general technical requirements specify the rate voltage, current, frequency, power factor, power consumption etc. The general constructional detail shall be described of the device. Salient features must present in a devices in case of additiona requirement.

6.5.4. Drawings

The Technical drawings shall be submitted in the tender submission document if required. The drawings may explain the graphical representation of the equipments or devices which shall be purchased.

7. DESIGN – 2

7.1. Introduction

We have learned Steps of electrical distribution planning and voltage drop calculation from Desig Department of DPDC (Room no- 1215), Biddut Bhaban (11th floor), 1, Abdul Ghani Road, Dhak 1000. Engineer Md. Aminur Rahman, Manager (Technical), Design-2 was our coordinator. On 1 July 2010 we were present there. Our schedule time was 9:00am to 5:00pm.

7.2. Electrical Distribution Planning

Mr. Aminur Rahman gave us a complete approach of an electrical distribution planning. DP follows certain criteria to establish Distribution lines. First of all we are taught about the idea t why planning is need to be performed. Planning is the way to select the policy/procedure to achi the mission, vision, goal, objective etc. The initial planning step is to estimate the magnitude of load to be supplied, including anticipated load development within the period under review, wit the specified geographic area. In electrical distribution planning the chronological steps that DP has taken are:

7.2.1. Identifying the Area

According to our coordinator identify the area of DPDC is to be done first. The whole project a should be divided into zones, one supply zone per 33/11 KV S/S or into sub-zones: one sub-zone 11 KV switching station, 11 kV feeders and Distribution transformers.

7.2.2. Mapping

Collect maps and/or mains records of the area of DPDC has to be supplied. 1:5000 and 1:1200 sc maps shall be used for all planning works. For small planning jobs where no proper maps available, sketch maps (not to scale) may be used. For larger jobs the Surveyor General shall requested to survey and map the project area. This procedure can take months or years depending the size of the area involved so that suitable notice must be given. If time does not permit for lo delay, this may be done through professional private survey companies after taking necess approval.

7.2.3. Recording Existing System

Collect details of the existing system of DPDC in the subjected area. This should be assembled the geographic main records maps of the area and on the relevant single line diagrams. Due to poor state of main record keeping in the past it should not be assumed that record drawing are up date and correct. Records should always be checked physically on site and amend as necessary.

7.2.4. Survey Existing Load

For surveying existing load, DPDC shall collect as much detail as possible of the existing loadi conditions in the subject urea. This should comprise the maximum loads on all 11 KV feeders a all distribution transformers. 11 KV feeder loadings are always available from substation records. time a program of checking and recording the maximum load at peak time of the year on distribution transformers on the system will be started. In the meantime, the data routinely availab from the C&M Circles may be utilized. Alternatively, loads may be estimated by counting t number and type of services with their connected load and supplying the diversity factors mentioned in the planning guide.

7.2.5. Load Forecasting

It is necessary for DPDC to estimate load forecasting for at least 5 years ahead of the load to catered for. A maximum of 7 years forecast must be made for sizing a 33/11KV substation. Th must be done by assuming an appropriate annual growth rate over the existing loads. Past recor may be a guide line in this respect. In addition, all known and possible future large loads (200K and above) must be taken into consideration. This will take the form known of possible futu developments such as office building, factories, residential areas etc. Location of all of those loa must be identified in order to plan the distribution feeders.

7.2.6. Planning the System

The position and size of all DPDC's transformers shall be decided. However, there must also taken into consideration the Route of feeder (cable + conductor). The two are interdependent. T location of all new and rehabilitated lines must then be decided. They should all run alongside roa close to the buildings they are to supply. Place of S/S in the proper area should come in consideration.

For distribution planning these phenomena should be considered carefully:

- The route of all overhead lines and cables
- The required size or capacity of all overhead lines and cables
- The location and capacity of all transformers
- The location of sectionalizing points and specifying the type of all switch and fuse gear
- The settings or rating of all protective devices (in liaison with protection engineer)

7.2.7. Voltage Drop Calculation in a Distribution Line

A case study:

Mr. Aminur Rahman showed us how to calculate voltage drop in a distribution line regardi Transformer MVA and distance between multiple transformers. For the system shown in Fig. 9 v determine the percent voltage drop to the high voltage terminals of each transformer running at fu rate. Assuming, Power factor = 0.8 (lagging) and Demand factor = 0.6

Suppose we consider an area with a substation of 11 KV feeders located at point A. There are thr transformers placed at point B, C and D. We draw a single line diagram of that Distribution lin

Now we need to calculate the end point voltage drop. The voltage drop calculation is needed if w want to minimize the loss at the distribution line and supplying quality rated voltage to the custom Other than this if distribution lines need to extend further we need voltage drop calculation. In c country at 11KV level maximum 3% voltage drop considered as acceptable range.

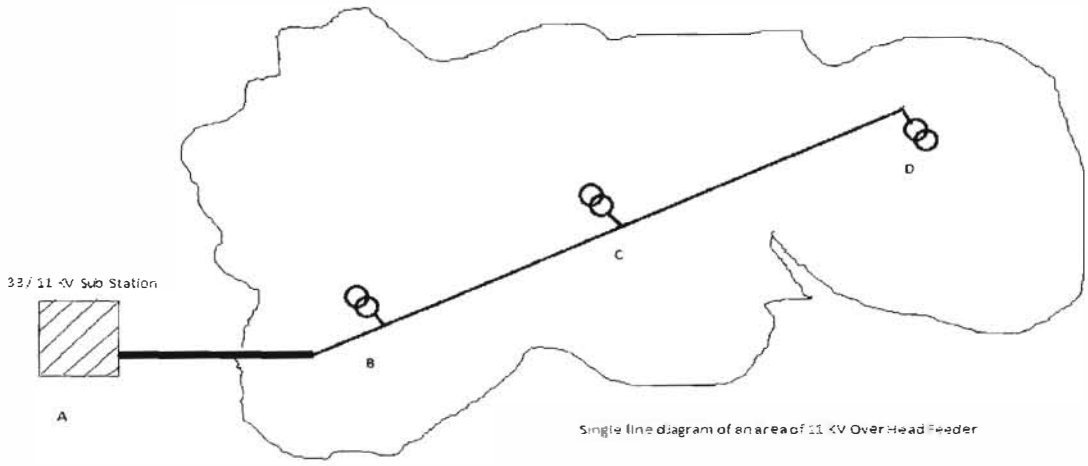
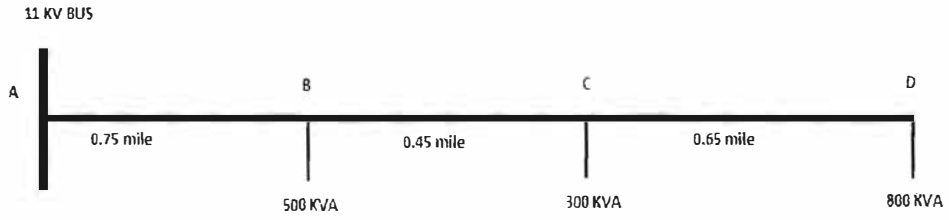
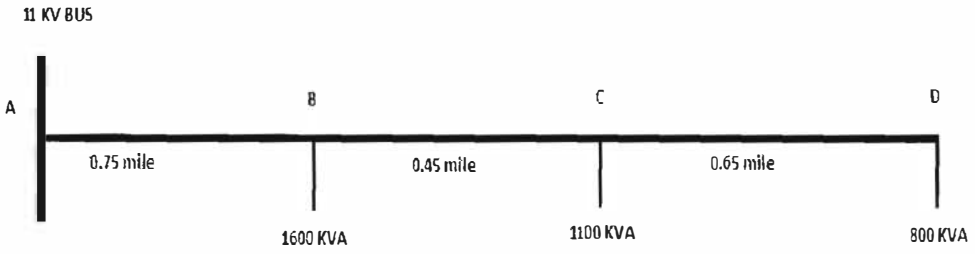


Figure 9: Geographical view of an area having S/S, distribution line, transformer

We simplified the geographical view to a single line diagram for easier calculation purpose. All t distance are in miles.



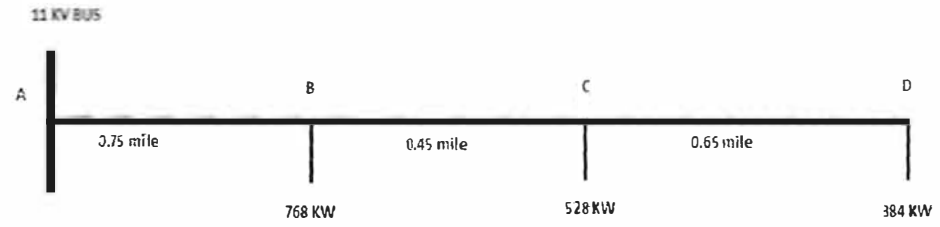
Now we add up voltage (KVA) of the transformer at second last point i.e. C (800 KVA+300 KVA 1100 KVA).similarly find at B point i.e. (800 KVA+300 KVA+500KVA= 1600 KVA)



For calculation we convert KVA rating to kilowatt rating by multiplying with Power factor = ((lagging) and Demand factor = 0.8

At point D, 800*0.6*0.8 = 384 KW, At point C, 1100*0.6*0.8 = 528 KW and

At point B, 1600*0.6*0.8 = 768 KW

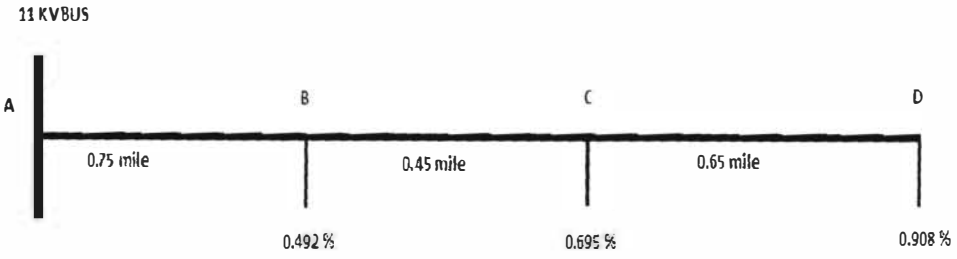


The formula for calculating voltage drop is given below:

Voltage drop at a point = (Load at transformer * Distance in miles) / Conductor's Resistivity factor

[Hint: Line's conductor's resistivity factor is 1170 kw-miles for 100 mm^2 cable]

Voltage Drop at point A = (768 * 0) / 1170 = 0 %
Voltage Drop at point B = (768 * 0.75) / 1170 = 0.492 %
Voltage Drop at point C = (528 * 0.45) / 1170 = 0.695 %
Voltage Drop at point D = (384 * 0.65) / 1170 = 0.908 %



Voltage drop at end point D is 0.908 %. This is acceptable as technical point of view. At 11 KV distributions level maximum acceptable range of voltage drop is 3.0%.

8. DESIGN – 3

8.1. Introduction

We have learned Operation and maintenance of substation, Essential part of a substat maintenance and protection of transformer, Operation and maintenance of circuit breaker, Opera and maintenance of relay, single line diagram of a complete substation, Different type of elect poles from Design-3 Department of DPDC (Room no- 1216), Biddut Bhaban (11th floor), 1, A Ghani Road, Dhaka -1000. Engineer Sanjit Kumar Ghosh, Manager (Technical), Design-3 was coordinator. On 17th July 2010 we were present there. Our schedule time was 9:00am to 5:00 We also visited Narinda grid substation and RMU at Dhaka stadium on that day. We observed equipment and operation of that S/S. We visited Bangabandhu National Stadium Ring Mean (RMU). Also observed load management, control room activity, power factor monitoring.

8.2. Single line diagram of Narinda S/S

Mr. Sanjit gave us an single line diagram of Narinda grid S/S. The Fig.10 shows single lin Narinda 132/33 kV grid substation. This S/S also has 33/11 kV part. There are seven feeder distribution level. New Ramna (132/33 kV s/s) gets one feeder, Kumartully (33/11 kV s/s) gets feeders, Bangshal (33/11 kV s/s) gets 2 feeders, Kajla (33/11 kV s/s) gets two feeders.

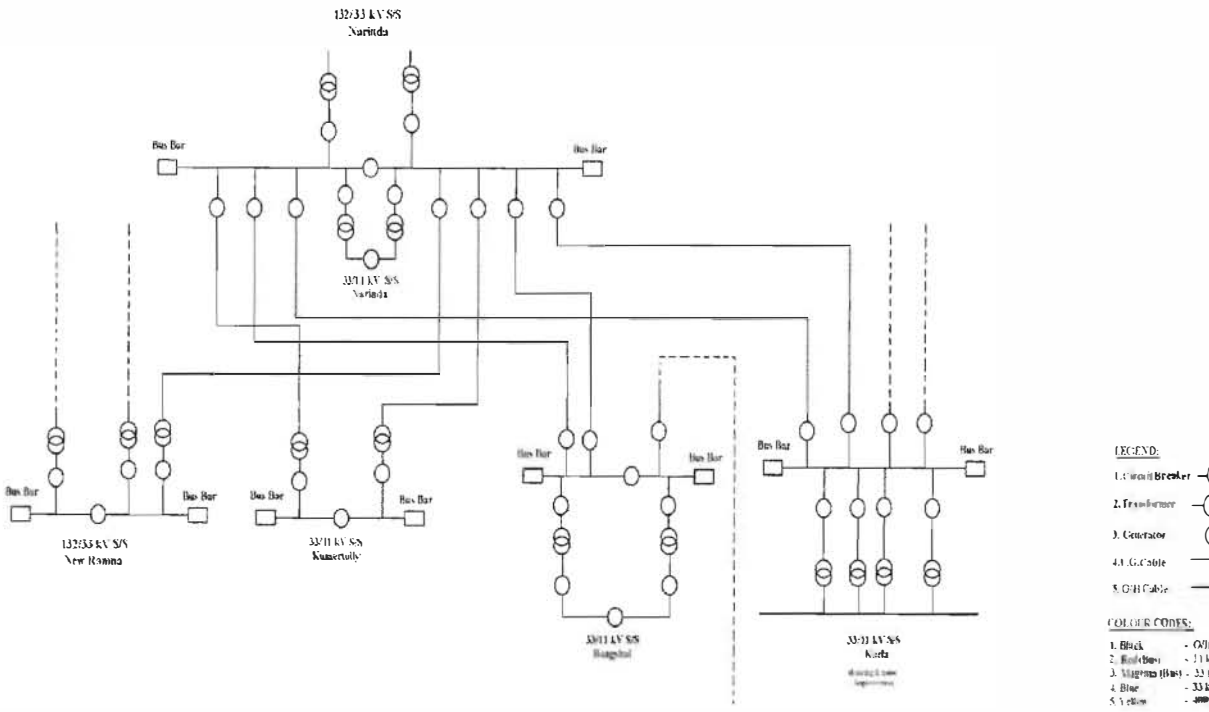


Figure 10: Single Line Diagram of Narinda S/S

8.3. Essential Parts of a Sub-Station

Our coordinator discussed about some S/S components. A substation needs some essential equipment to run the S/S properly. A substation must contain the following components:

- Power transformer.
- Current Transformer.
- Potential Transformer.
- Circuit Breaker.
- Isolator
- Lightening Arrester / Surge Diverter.
- Auxiliary Transformer.
- Bus bar.
- Battery and Battery Charger.
- Control Relay Panel.
- AC & DC Distribution Panels.
- Conductor

8.4. Maintenance and inspection of Sub-Station Equipment

According to Mr. Sanjit S/S equipments of a sub-station required frequent maintenance and Inspection. It is always necessary to maintain and inspection on a schedule basis. Following are the listed maintenance and inspection list:

Maintenance of Substation Equipment

The maintenance of a substation should be on regular basis. It may be based on time or emergency basis. They are listed below:

- Schedule Maintenance.
- Emergency maintenance.

Inspection of Substation Equipment

Substation equipment should be inspected frequently. Otherwise the efficiency can be lower by the time. The inspection schedules are given below:

- Daily Inspection.
- Weekly Inspection.
- Monthly Inspection.
- Quarterly Inspection.
- Half-yearly Inspection.
- Annual Inspection.

8.5. Maintenance of Transformer

A transformer is the main part of a S/S as told by our coordinator. A power transformer requires frequent maintenance. Maintenance ensures proper rated voltage, frequency, and efficient voltage stepping for long time. We need the following listed maintenance of a transformer.

Test oil sample of transformer main tank & tap changer tank

- Check condition of oil gauges and oil level.
- Check for oil leakage & integrity of gasket joints.
- Check the tightness of nuts & bolts.
- Check the insulation resistance of bushing.
- Check that silica gel crystals are blue.
- Check the performance of oil temperature & winding temperature meter.
- Check insulation resistance between each winding and ground
- Check of physical condition and the insulation resistance.
- Check tightness of primary side & secondary terminals.
- Check the ratio and justify the accuracy.
- Check for oil leakage for oil immerged CT and PT.
- Check the dielectric strength of oil.

8.6. Maintenance of Circuit Breaker

Circuit breaker is also another essential part of a S/S as told by Mr. Sanjit. During the abnormal or faulty condition a circuit breaker operate by clearing the fault by opening the contact from the faulty part. The opening should be always automatic. But the closing may be manually done if necessary.

The maintenance of circuit breaker is done by the following way:

- Timing and Insulation resistance test.
- Measurement of contact resistance.
- Check SF6 gas pressure and the Charging Mechanism.
- Check security of couplings and pipes.
- Measurement condensation temperature (Dew point) of gas.
- Check operation of pressure gauges, hydraulic pressure.
- Check accumulator pre-charge pressure.
- Check for oil leaks and low pressure oil tank oil level.

8.7. Types of Relay

There are different types of relay as informed us by our coordinator. Protective relaying is necessary with almost every electrical plant. Between generators and the final load points, there are several electrical equipments and machines of various ratings each need certain adequate protection. The protective relaying senses the abnormal conditions in a part of the power system and gives an alarm or isolates that part from the healthy system. There are different types of relay.

- Electro-mechanical.
- Static relay.
- Digital or Numerical.

8.8. Maintenance of Relay

Mr. Sanjit told us that maintenance is continuous process, where the operation will be done according to the proper maintenance of the relay in a schedule basis. Following maintenance is done accordingly.

- General cleaning of both inside and outside.
- Check for looseness of connections.
- Check operation and accuracy of instruments.
- Carry out insulation tests between wiring and earth, and between circuits.
- Check operation of all alarms and control functions.
- Carry out secondary injection tests of relays.

8.9. Single Line Diagram of a Complete Sub-Station

A complete substation's diagram is provided by Mr. Sanjit where there are various indoor and outdoor switchgear equipment. Each equipment has a certain functional requirement. The equipment are either indoor or outdoor depending upon the voltage rating and local condition. Generally indoor equipment is preferred for voltage up to 33 kv . For voltage of 33kv and above, outdoor switchgear is preferred. The outdoor equipment is installed under the open sky. The bus bar is made of rigid aluminum tube supported on post insulator. Incoming and outgoing circuits are connected to bus bars. A complete S/S contains three levels of bus bar. They are 132 kV, 33 kV and 11 kV.

Circuit breakers are the switching and current interrupting devices. A bus coupler is a device which is used switch from one bus to the other without any interruption in power supply and without creating hazardous arcs. Power transformer is used to step up or down the voltages and transfer power from one AC voltage to another AC voltage at the same frequency. Fig.11 shows a complete single line block diagram of a substation.

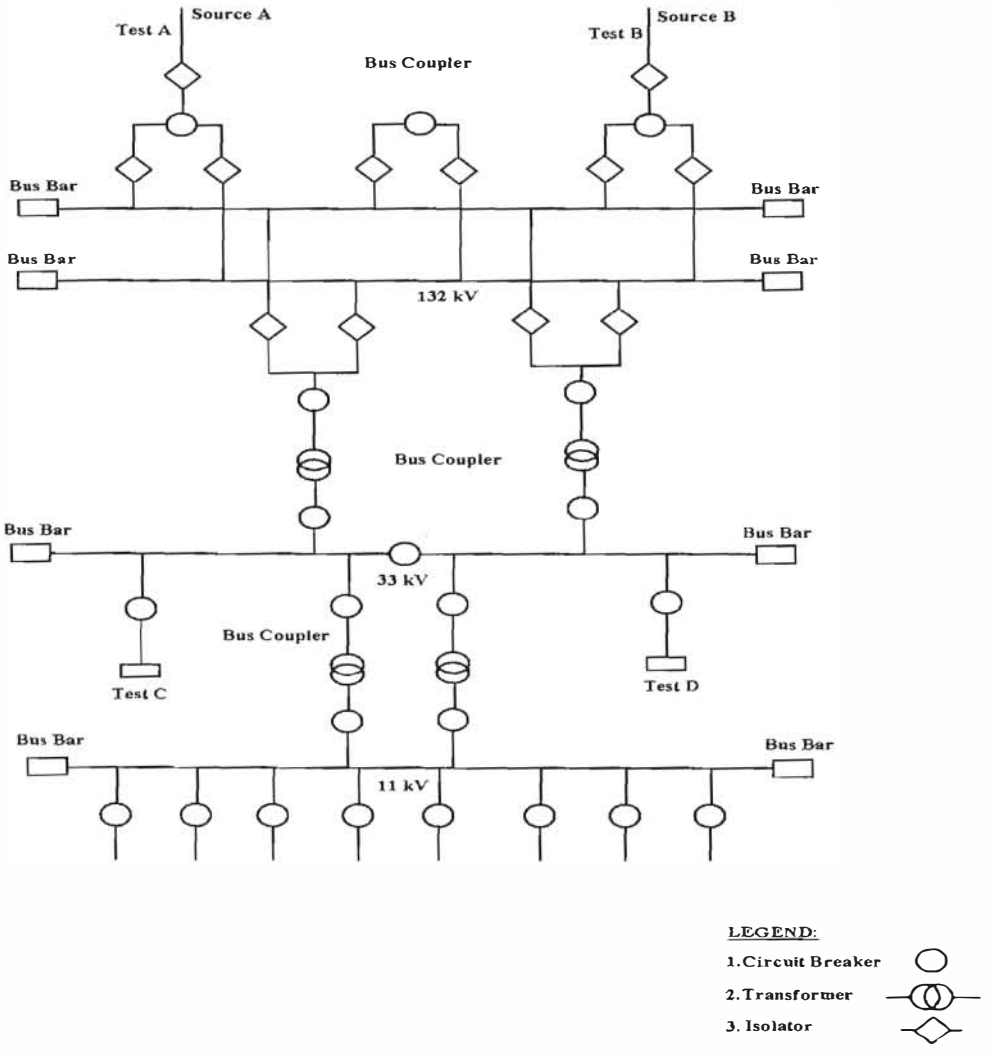


Figure 11: Single Line Diagram of S/S, grid, distribution line & electrical equipment

8.10. Different Types of Poles

Mr. Sanjit provided us installation diagram of electrical poles which are commissioned by DPDC. An electrical pole is used to carry overhead electrical wire for supporting purpose (swing). Different types of pole are found in our distribution system e.g. top mount pole and side mount pole. Pole is made of R.C.C. (reinforced cement concrete) or wood. Fig.12 (a) and (b) shows the dimension for constructing two types of pole. All measurement is in millimeter.

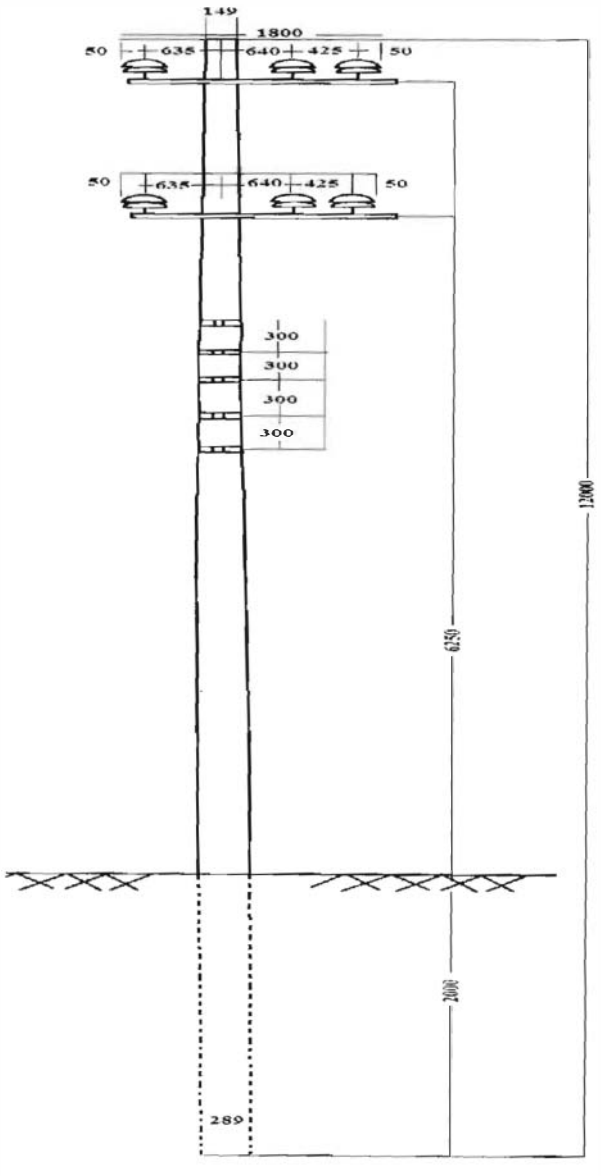
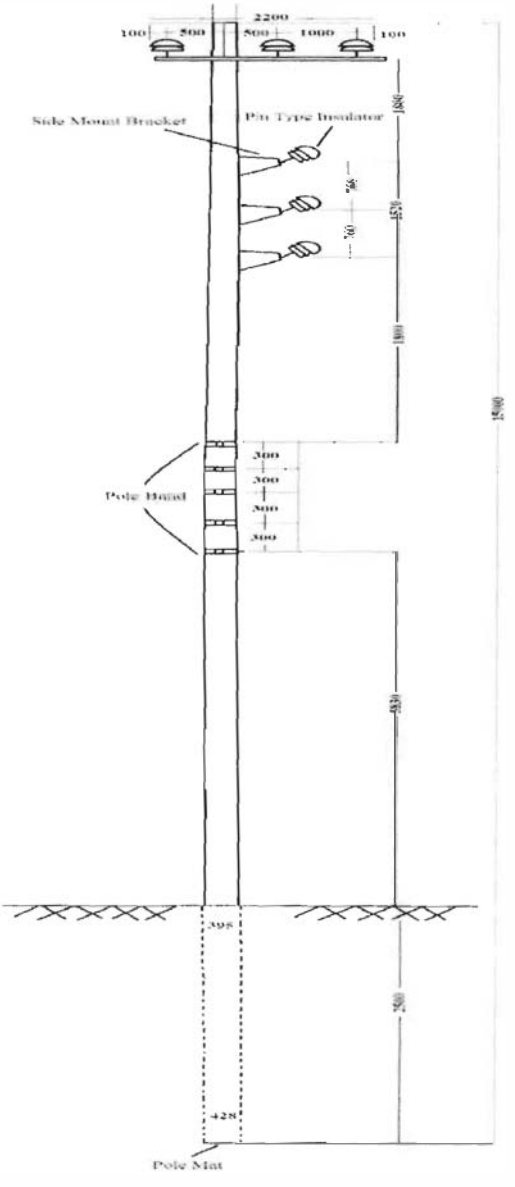


Figure 12: (a) Top Mount Pole



(b) Side Mount Pole

A pole contains many components to supplement a transformer connection. The isolator or disconnecting switch is used for disconnecting a circuit from the faulty side. Lighting arresters (surge arresters) divert over-voltages to earth and protect the equipment from over-voltages. Bracket is used to hold the above components. Insulator separates a conductor of electricity from other conducting body. Fig.13 shows the pole connected with different electrical component.

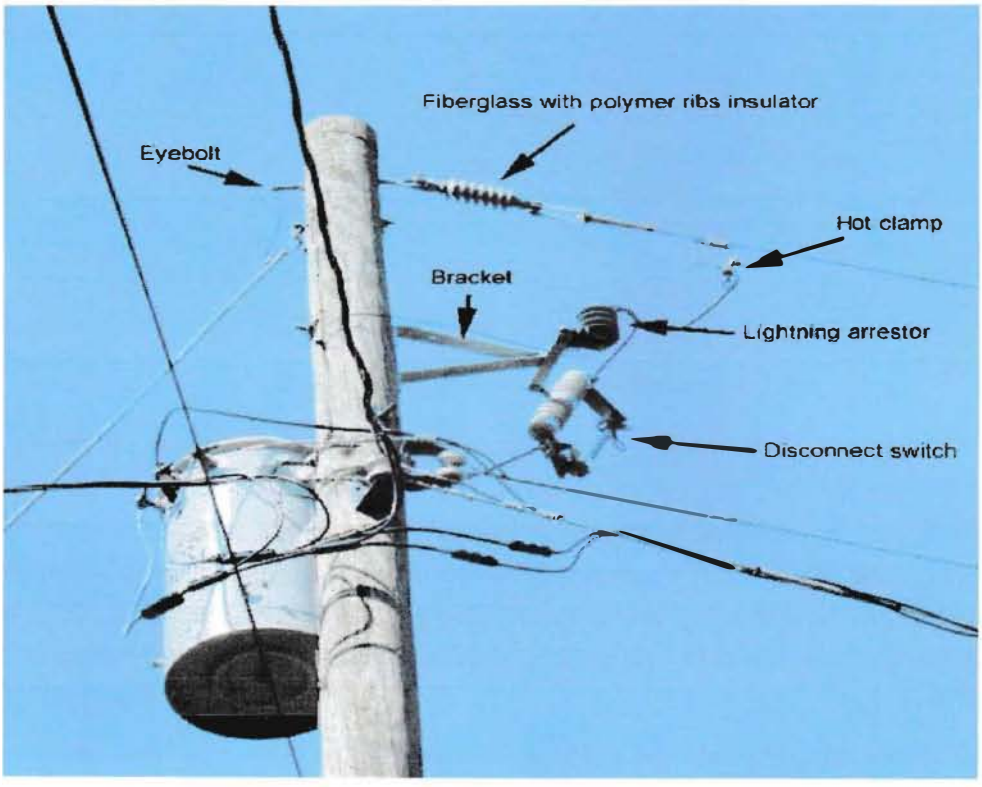


Figure 13: Distribution Transformer with Pole connection & electrical equipments

In a electrical pole transformer, different types of wire are connected for transmitting energy and communication purpose. Usually primary wires connected with H.T. side of distribution transformer and have 11 kV. Secondary wires connected with L.T. side of distribution transformer and each wire has 240 volts. The electrical connection of houses is taken from the secondary wire. Sometimes phone lines are connected to the electrical pole. Fig.14 describes common electrical distribution line connection.

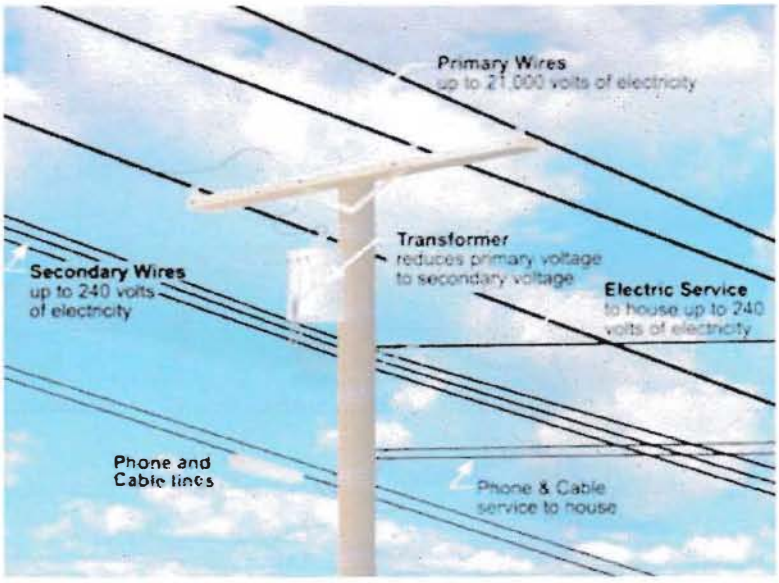


Figure 14: Common Electrical Distribution Lines

8.11. Power Distribution in an interconnected Power System

According to our coordinator the necessity of proper power distribution is very important as he discussed it briefly to us. Modern Electrical power systems are large interconnected AC network. The total network is divided into a few regional zones (Areas). Each area controls its own load, frequency and generation. Adjacent independently controlled areas are interconnected to from a Regional/National Grid.

The National Load Control Centre determines the exchange between regional zones. Regional load control centre control generation in the respective zone to match the prevailing load so as to maintain frequency within target (49-51 Hz). During the low frequency /high load the region imports power from adjacent surplus region. During the high frequency /low load the region export power.

8.12. Voltage levels in Network and Sub-Station

There are several voltage levels in the total power supply system as discussed by Mr. Sanjit. The network has various voltage levels for generation, transmission, distribution, utilization, control and protection. Generation is at voltage up to 11 kV AC r.m.s. (phase to phase). This is due to design limitation of AC generators. Long distance high power transmission is by Extra High Voltage (EHV) AC lines rated 132 kV, 220 kV, 400 kV, 760 kV. For long distance and higher power, higher voltage is economical and essential. In special cases, HVDC transmission is preferred. The rated voltage for long distance HVDC transmission are ±400 kV, ±500 kV, ±600 kV. Backbone transmission network is by EHV AC transmission lines (400 kV AC).Distribution is at lower AC voltages between 132 kV AC and 3.3 kV AC. Utilization is at low voltage (up to 1 kV) and medium voltage up to 33 kV. The factory sub-station received power at distribution voltage up to 33 kV and step it down to 440 volts

AC. Larger factories receive power at 132 kV and having internal distribution at 3.3 kV, to 440 volts AC. The Fig.15 shows difference voltage level from power generation to distribution through step-up or step-down transformer.

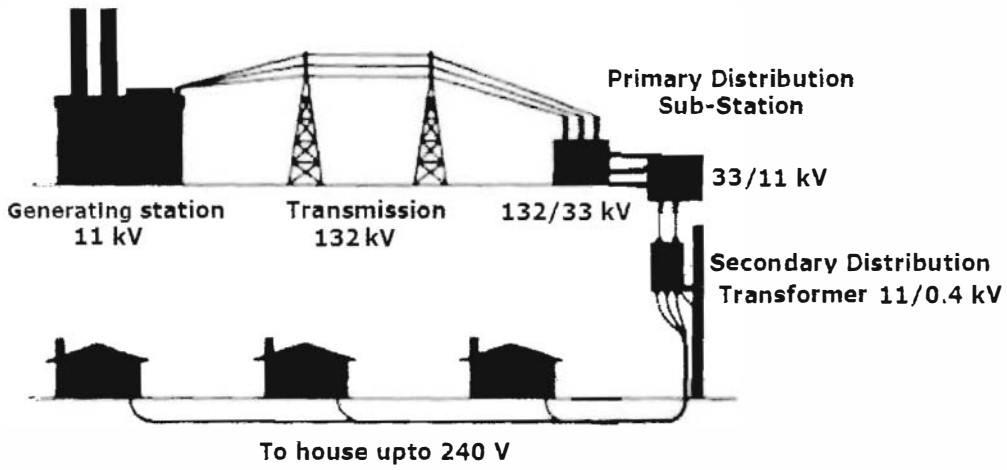


Figure 15: Diagram of Power Distribution system with transformer voltage rating

9. SYSTEM OPERATION AND SCADA

9.1. Introduction

We have learned about SCADA and its functional activities, SCADA system components, SCADA communication in DHAKA division and online statistics of SCADA by DPDC from System Operation & SCADA (Dhanmondi, Katabon). Engineer Md. Abul Kalam Azad, Deputy Manager (Technical), System Control & SCADA Circle, Dhaka Power Distribution Company Ltd, 3, Sonargaon Road, Katabon Dhaka was our coordinator. On 24th July 2010 we were present there. Our schedule time was 9:00am to 5:00pm.

9.2. Supervisory Control and Data Acquisition

We are taught about SCADA and its operation from our coordinator. SCADA is an acronym that stands for Supervisory Control and Data Acquisition. SCADA refers to a system that collects data from various sensors at a factory, plant or in other remote locations and then sends this data to a central computer which then manages and controls the data.

Mr. Kalam informed us about the versatile uses of SCADA system not only in Electrical system but also in other sectors. SCADA is a term that is used broadly to portray control and management solutions in a wide range of industries. Some of the industries where SCADA is used are Water Management Systems, Electric Power, Traffic Signals, Transit Systems, Checking statuses of sensors, Environmental Control Systems and Manufacturing Systems.

Our coordinator explained about the peripherals and control interfaces of SCADA. He told us that a SCADA system usually includes signal hardware (input and output), controllers, networks, user interface (HMI), communications equipment and software. All together, the term SCADA refers to the entire central system. Most control actions are performed automatically by Remote Terminal Units (RTU) or by programmable logic controller (PLC). In SCADA systems, RTUs and PLCs perform the majority of on-site control. The RTU or PLC acquires the site data, which includes meter readings, pressure, voltage, or other equipment status, then performs local control and transfers the data to the central SCADA system.

9.3. Overall Functional Activities of SCADA

Mr. Kalam told us some of the functional activities of SCADA. SCADA has functional advantages on various electrical control systems. On demand basis, it is used at the Load Distribution Center for the efficient load management. The functional activities of SCADA are listed below:

- During the power crisis efficient power management can be done using scada system. This is done by load sheeding in a balanced way which is generally known as LDC (Load Distribution Center).
- To manage load demand during distribution system break down or overloading.
- To keep informed top-level management about power supply status during any emergency situation.
- To provide daily and monthly power supply status reports to the top management and other related agencies.
- According to the priority base demand load shedding is occured. e.g. The electricity supply to the residence of president and Prime Minister should never interupted.
- All electrical equipments in the existing system can be operated automatically using special computer software in scada system.
- By using SCADA system Cost reduced efficiently.Because less manpower is needed.Manpower used only for controlling purpose.
- Maintanence team informed in case of any fault occured in the system.
- Billing system (metering) for large consumer is made from SCADA.
- For long transmision line, if any fault occured then identification is a problem.By scada system fault calculation and location of fault area can be identified easiely.

To attend above mentioned activities, experienced engineers and operators are engaged round the clock in the SCADA central control room.

9.4. SCADA System Component

As far as we have seen the SCADA system, we learned about the components of this system. A SCADA System usually consists of the following subsystems, which is very essential to accumulated all the SCADA peripherals. A Human-Machine Interface is the apparatus which presents processed data to a human operator and through this the human operator monitors and controls the process. The supervisory (computer) system acquires data on the process and sending commands to the process.

Mr. Kalam informed us about the backbone of RTU. According to him the Remote Terminal Units (RTUs) are connecting to sensors in the process by converting physically sensed signals to digital data and sending this data to the supervisory system. Programmable Logic Controller (PLCs) used as field devices because they are more economical, versatile, flexible, and configurable than special-purpose RTUs. Communication infrastructure connecting the supervisory system to the Remote Terminal Units is shown Fig.16.

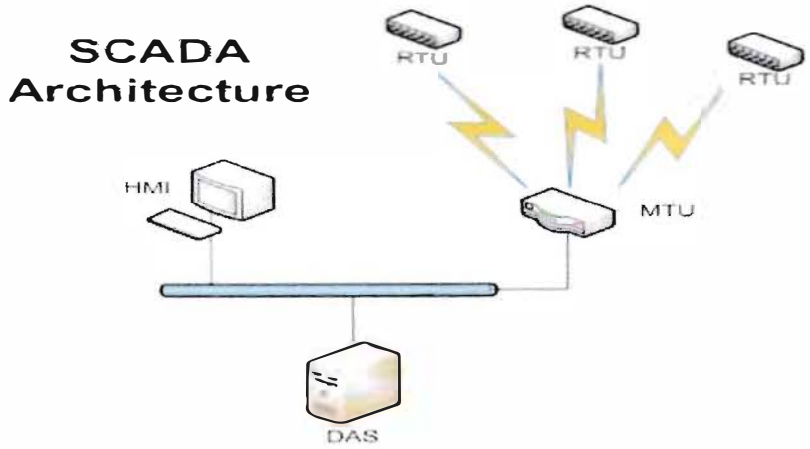


Figure 16: SCADA Architecture

9.5. Human Machine Interface (HMI)

Our coordinator discussed some technical facts about the HMI. The HMI of a SCADA system is where data is processed and presented to be viewed and monitored by a human operator. HMI's are an easy way to standardize the facilitation of monitoring multiple RTU's or PLC's (programmable logic controllers). Usually RTU's or PLC's will run a pre programmed process, but monitoring each of them individually can be difficult because they are spread out over the system. RTU's and PLC's had no standardized method to display or present data to an operator, the SCADA system communicates with PLC's throughout the system network and processes information that is easily disseminated by the HMI. HMI's can also be linked to a database, which can use data gathered from PLC's or RTU's to provide graphs on trends, logistic info, schematics for a specific sensor or machine or even make troubleshooting guides accessible.

9.6. Remote Terminal Unit (RTU)

The brains of a SCADA system are performed by the Remote Terminal Units according to our coordinator. The RTU connects to physical equipment. Typically RTU converts the electrical signals from the equipment to digital values such as the open/closed status from a switch or a valve or measurements such as pressure, flow, voltage or current. By converting and sending these electrical signals out to equipment the RTU can control equipment, such as opening or closing a switch or a valve, or setting the speed of a pump. RTU is a microprocessor controlled electronic device which interfaces objects in the physical world to a distributed control system or SCADA by transmitting telemetry (a technology that allows remote measurement and reporting of information) data to the system or altering the state of connected objects based on control messages received from the system. Fig.17 shows the block diagram of RTU component.

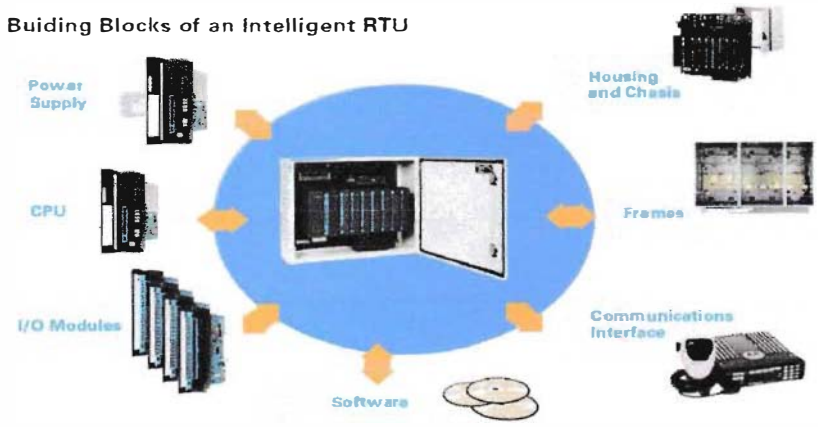


Figure 17: Building Blocks of RTU

9.7. Communication Infrastructure and Method

Mr. Kalam taught us about the communication method of SCADA system. SCADA systems have traditionally used combinations of radio and direct serial or modem connections to meet communication requirements. The remote management or monitoring function of a SCADA system is often referred to as telemetry. These communication protocols are standardized and recognized by all major SCADA vendors. It is good security engineering practice to avoid connecting SCADA systems to the Internet so the attack surface is reduced. When distance is short then we use physical wire for communication. For long distance physical wire is not suitable, because in copper cable data becomes attenuated and there is a chance for missing data. To solve this problem we can use fiber optical cable. But we need a fiber converter here. So, for long distance communication best way is to use radio link for sending and receiving data. Frequency range is UHF in radio link.

9.8. SCADA in Bangladesh

Our coordinator gave a brief history on SCADA system in Bangladesh. SCADA was started functioning from July 1998 to control Distribution System operation from one point through Microwave link. All 132/33 KV & 33/11 KV substations located within the Greater Dhaka District area are linked with SCADA central control room located at Katabon, Dhaka. Within capital city area 11 KV line from 33/11 KV substation are also incorporated with the SCADA system. SCADA central control room manages the load and distribute to different area within Greater Dhaka District by contacting Power Grid Company of Bangladesh (PGCB)'s load dispatch centre and with the regional control rooms.

9.9. SCADA Control System Communication in Dhaka Division

Mr. Kalam gave us a map of interconnected communication of SCADA system of DPDC. The communication media used in SCADA system are radio link, pilot wire for receiving and sending data between the S/S. Fig.18 shows the block diagram of SCADA communication system of Dhaka division.

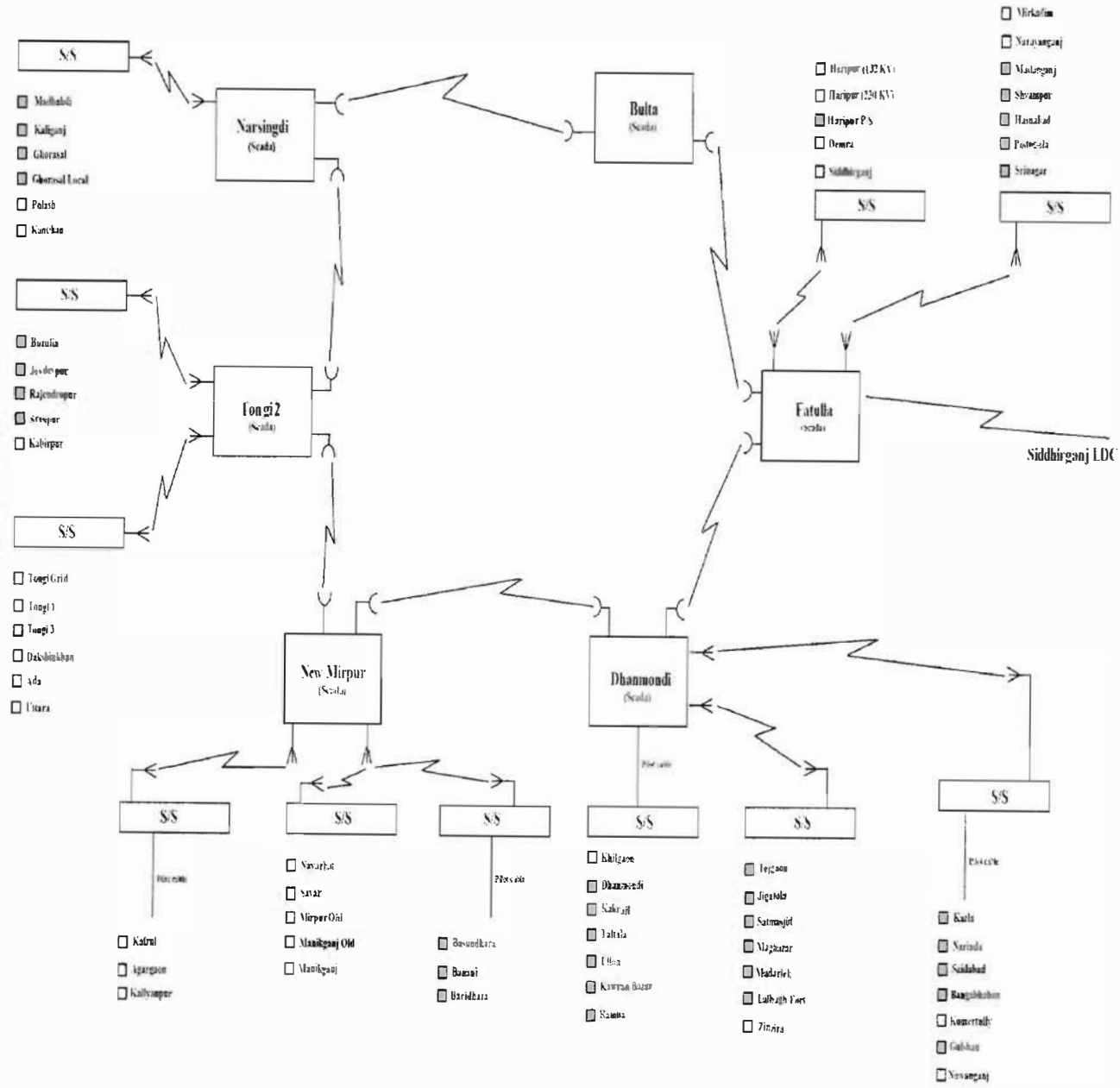


Figure 18: SCADA Control System Communication in Dhaka Division

9.10. Online Statistics in SCADA by DPDC

A day to day comparison of generated voltage of transmission line, Supply and demand of energy for the consumer from present and past records is listed in online statistics of SCADA. Online Statistics in SCADA by DPDC are showed below:

Last Update: 22-11-2010, 3:00 PM

Nominal System Status	Current System Status
132 KV voltage	125.9 KV
33 KV voltage	30.6 KV
11 KV voltage	9.9 KV
Power Factor	0.89
Yesterday	
Supply	497.3 MW – Yesterday (8:00 PM)
System Demand	497.3 MW – Yesterday (8:00 PM)
Load Shedding	0 MW – Yesterday (8:00 PM)
Today	
Supply	497.3 MW – Yesterday (8:00 PM)
System Demand	497.3 MW – Yesterday (8:00 PM)
Load Shedding	0 MW – Yesterday (8:00 PM)
50Hz Frequency	50.6 Hz

10. CONCLUSION

An essential precondition for industrial development is uninterrupted supply of energy. In generating and distributing electricity, the failure to adequately manage the load leads to extensive load shedding which results in severe disruption in the industrial production and other economic activities.

A major hurdle in efficiently delivering power is caused by the inefficient distribution system. It is estimated that the total transmission and distribution losses in Bangladesh amount to one-third of the total generation. Problems in the Bangladesh's electric power sector include corruption in administration, high system losses, and delays in completion of new plants, low plant efficiencies, erratic power supply, electricity theft, blackouts, and shortages of funds for power plant maintenance. Overall, the country's generation plants have been unable to meet system demand over the past decade.

The government has embarked on a well-planned policy to generate more energy through higher public and private investment, reduce system loss to the minimum and harness natural gas, solar power, atomic power and hydroelectric resources. Providing electricity efficiently to the consumer with new ideas, DPDC has become the role model for the other government organizations. To attain the higher international quality of services DPDC is always a step ahead than other electrical companies in Dhaka.

Through our whole internship program we try to summarize the whole idea about their activities. We are taught the function and works of every department gradually. We observed and noted from the very beginning to the end of a complete project establishment through planning, designing, tendering, technical evaluation, prospect and viability gradually. The daily, monthly and yearly progress report, executive summary and annual development report help us to visualize the mass area in an organization.

A combined and organized structure is present in this organization. Within two and a half years, successful strategies make the company profitable and by the modern services through CSS and DSS it ensures a bright future in the energy sector. Providing flawless services at distribution level with upgrading and maintaining distribution lines, underground cable, substations, transformer, RMU as well as constructing new distribution line to provide energy for consumer, DPDC is strongly committed. In case of electrical disasters and fault, the team is dedicated to provide services at once. Continuous improvement by their services and strategies, DPDC maintains its MOTO (Dependable Power - Delighted Customer). With energetic and corruption less employee and their up to date services DPDC will become superior power distribution company.

APPENDIX A

Acronyms

- ADB Asian Development Bank
- IMF International Monetary Fund
- JICA Japan International Cooperation Agency
- MDG Millennium Development Goals
- 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 Polli Biddut Samity
- PDB Power Development Board
- REB Rural Electrification Board
- PGCB Power Grid Company Bangladesh
- DPP Development Project Proforma
- PP Project Proforma
- NPV Net Present Value
- ADP Annual Development Program
- BCR Benefit-Cost Ratio
- IRR Internal Rate Return
- PPP Public Private Partnership

APPENDIX B

Bibliography

- Executive Summary for the month of March 2010, Dhaka Power Distribution Company Ltd.
- Annual Report 2008-09, Dhaka Power Distribution Company Ltd.
- Monthly report for the month of April 2010, Dhaka Power Distribution Company Ltd.
- Public Procurement Law 2008,(Internal Document of Dhaka Power Distribution Company Ltd)
- www.powercell.gov.org.bd (Supplementary Information Acquired)
- www.mof.gov.bd (Web site for financial management analysis)
- www.cptu.gov.bd (Web site for Tender Preparation)
- www.dpdc.org.bd (Web site of Dhaka Power Distribution Company Ltd)
- www.bpdb.gov.bd.org (Supplementary Information Acquired)