INTERNSHIP REPORT ON

POWER GENARATION, DISTRIBUTION & MAINTAINACE OF

POLLI BIDYUT SOMITY -1

By

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2008-1-80-043

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)

[Spring Semester, 2012]

Approved By

Academic Advisor	Department Chairperson
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Lecturer	Chairperson & Associate Professor
Electrical & Electronic Engineering	Electrical & Electronic Engineering

Approval Letter

ঢাকা পল্লী বিদ্যুৎ সমিতি-১
পলাশবাড়ী, নবীনগর,
সাভার, ঢাকা।

দুরালাপনী ঃ ৭৭৯১৬১০
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TO WHOM IT MAY CONCERN

This is to certify that **Md.Rafluzzaman Khan, SID 2008-1-80-043** has successfully completed his internship from Dhaka Palli Bidyut Somity-1. (DPBS-1) from 25th December 2011 to 10th February 2012. He has completed more than 100 hours for his internship on power generation, transmission, distribution and protection system of the various sub-station equipments of Dhaka Palli Bidyut Samit -1, Summit Power Generation and United Power Generation and Distribution Company Ltd. During the tenure of their training with us he puts his best effort to comprehend the overall of Power Distribution system.

The undersigned on behalf of Dhaka Palli Bidyut Samity -1 (DPBS-1), recommending this work as the fulfillment of the requirements of EEE 499 (Industrial training) of the East West University.Dhaka.

Wish him success in life.

17/02/12

Engr. Prasanta Kumar Sutradhar
Assistant General Manager
Construction. Operation & Maintenance
Dhaka Palli Bidvut Samity-1

17.02.12

Engr. Abul Kalam Azad Assistant
General Manager (Engineering)
Dhaka Palli Bidyut Samity-1

Acknowledgment

At the very beginning, I would like to thank the omnipotent Allah for giving the chance to complete my internship and preparing the internship report. The spatial thanks go to my helpful supervisor AGM of REB Engineer Md. Abul kalam Azad. The supervision and support that he gave truly help the progression and smoothness of the internship program. The co-operation is much indeed appreciated.

My grateful thanks also go to both Mr. Saiful Islam and Engineer Sushanto. A big contribution and hard worked from both of you during the internship period is very great indeed. All projects during the program would be nothing without the enthusiasm and imagination from both of you. Besides, this internship program makes me realized that the value of working together as a team and as a new experience in working environment, which challenges us every minute. The whole program really brought us together to appreciate the true value of friendship and respect of each other.

Great deal appreciated goes to the contribution of my advisor Fakir Mashuque Alamgir sir.

Last but not the least I would like to thank my parent; I am always inspired by them. I also like to thank my friends especially those who work together as intern at REB.

Executive Summary

Electricity is a fundamental requirement, to upgrade the socio economic condition and to alleviate poverty. Proper and enough electricity supply have a great positive impact on our national economy as well as on GDP of the country, where GDP is one of the important measures of the economic condition for a developing country like Bangladesh to attract foreign investment. But Bangladesh is going through a huge power crisis for a long time. Demand of power is very high but supply is not adequate.

Rural Electrification Board is the largest electricity distribution company in Bangladesh which is covering 61 districts and 48,687 villages. Through 70 Somity REB operates and among this Polli Bidyut Somity-1 is one of the best electricity distribution companies among its kinds. This is situated in Nobinogor, Savar. I started my internship on 25th December 2011. Before starting my internship in PBS-1, an internship was scheduled and a group list was provided with the internship approval letter by PBS-1. During our internship we have been visited several places such as Summit Power Limited, United Power Generation and distribution Company Limited, Power Grid Company Bangladesh and their own distribution substation etc. Both generation and distribution is maintained by PDB (Power Development Board).

From my internship I have learned about REB power generation, power distribution, staking design and supervision and the electrical equipments they are using other things. The experience of our internship was enjoyable and learnable.

Internship Schedule

Description	Location	Date	Supervisors	Time	Hour
Power Generation in Summit Power Limited	*Ashulia*, Savar, *Dhaka*	25th ,26th & 27th December 2011	Engineer Habib	9.30-4.00	18.00
United Power Generation and Distribution Company Limited	EPZ Savar, Dhaka	4th &5th January, 2012	A.S.M. Ahsan Habib	9.30-5.00	14.00
Grid Substation	Hamannogor, Savar	10th January, 2012	Safiul Islam	9.30-4.00	6.00
Distribution Substation	Nobinogor, Savar &Kushora Dhaamrai	11th &12th January, 2012	Saiful Islam	9.30-4.00	12.00
Staking, Design and Supervision	Nobinogor, Savar	16th January, 2012	Engineer Shushanto	9.30-5.00	7.00
Construction, Operation and Maintenance	Nobinogor, Savar	18th &19th January, 2012	Engineer Shushanto	9.30-5.00	14.00
Nipor Service	Nobinogor, Savar	22th &23th January, 2012	Safiul Isam	9.30-5.00	14.00
Engineer service	Nobinogor, Savar	24th,25th &26th January, 2012	Engineer Shushanto	9.30-5.00	21.00
Member Service	Nobinogor, Savar	5th February , 2012	Mr. Rakeb khan	9.30-4.00	6.00
Finance Section	Nobinogor, Savar	7th February , 2012	Ms. Jinnat Rahaman	9.30-4.00	6.00
Consult Service	Nobinogor, Savar	9th February , 2012	Mr.Abul Bashar	9.30-4.00	6.00
			Total	**=**	**124 hours**

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Company profile

1.1 Motivation of Internship:

Internship is the part of the undergraduate degree in EEE department of the East West University. I get the theoretical and practical knowledge from Internship which is important for my career. For developing the practical knowledge I want to do internship. I had completed my major area in Power Engraining at Rural Electrification Board or Polli Bidyut Somity which is the leading electricity distribution company in rural and industrial area in Bangladesh. Polli Bidyut Somity-1 has ensured me, the best support for developing the practical knowledge with the help of the theoretical knowledge. In my internship I have learned how power plant generate power, what is the distribution system or process for Power Distribution Company and other relevant topics. The objective of this internship report is, it will be the important source for the people, who want to do thesis in power sector or power distribution system. At the end of this report, a short summary about the industrial training will be discussed.

1.2 Company profile:

The Bangladesh Rural Electrification (RE) Program was founded with a Presidential Ordinance in October 1977 that established the Rural Electrification Board (REB) as the semiautonomous government agency reporting to the Ministry of Power Energy and Minerals Resources, which was responsible for electrifying rural Bangladesh. Since its inception, the purpose of the program has been to use electricity as a means of creating opportunities for improving agricultural production and enhancing socio-economic development in rural areas, whereby there would be improvements in the standard of living and quality of life for the rural people.

REB sets forth the following major objectives in implementing the rural electrification program:

- Ensure peoples participation in policy formulation in a democratic way.
- Provide reliable and sustainable electricity to the rural people at affordable price.
- Improve economic condition of the rural people by using electricity in agriculture, cottage and agro based industry.
- Improve living condition of rural peoples.
- Bring about entire rural Bangladesh under RE program or an area coverage basis.

To fulfill the objectives today there are 70 operating rural electric cooperatives called Palli Bidyuit Samity (PBS), which bring service to approximately 79, 00,000 new connections are made and more than 14,000 kms of line being constructed each year. Now a day they are also launching a new program which is known as one client one ampere. Among this 70 PBS, except PBS-1 all are in loss.There are six departments in each PBS:

- Member Service
- General Service
- NIPOR Service
- Finance Department
- Revenue
- Engineering Section

The greatest result of Rural Electrification program has been achieved in the agricultural sector. The use of electric pumps for irrigation in the dry seasons (January-April) brought revolution in the food production system. IRRI paddy produced in this dry period fully depends on irrigation from surface or underground water. Hand driven tube wells proved to be inadequate for large fields and diesel pumps are too expensive source of water. Diesel pumps need regular maintenance, skilled operators and mechanics are not readily available. This method of irrigation lost popularity in course of time and farmers showed reluctance to use diesel pumps.

Comparatively cheap irrigation of land is provided by electric pumps which need negligible maintenance.

As a result, popularity of electric irrigation pumps among farmers of Bangladesh has grown up in past years. With less than 2000 electric pumps in 1981-82 Fiscal Year, the number of pumps come under electrification has increased tremendously exceeding 1, 34,690 up to December 2011. The Rural Electrification Board and govt. trying to popularizing electric pumps in agricultural sector which is very important for our food production system. Although tariff of all other categories of consumers has gone up over a period of time, tariff for irrigation consumption remains almost same for last five years. It enables the farmers to keep cost of production low and price of products competitive in the market.

The followings are the main features of rural electrification in Bangladesh as on December, 2011. [1]

Number of RES organized	**70**
Number of RES operating commercially	70
Number of district under the program	61
Number of Up-Zillas under the program	433
Number of villages electrified	48,687
Total distribution line constructed	2,22,930 Km (June'11)
Total distribution line energized	2,28,528 Km (June'11)
Total 33/11 KV sub-stations constructed and commissioned	426 (343 Constructed by REB, 83 taken over from PDB/DPDC/OTHERS)
Installed Capacity of Sub-stations	2825 MVA

Total number of consumers	84,22,310
Total number of irrigation pumps connected	1, 34,690
System Los	14.85% (cumulative),12.03% (jun'11)

1.3 Territory of REB:

REB already covered almost all of part of our country. Mainly they provide electricity in rural people but they also distributes in industrial areas. They covered all most 2, 22,930 Km line. The territorial map is given below in consists of figure 1:

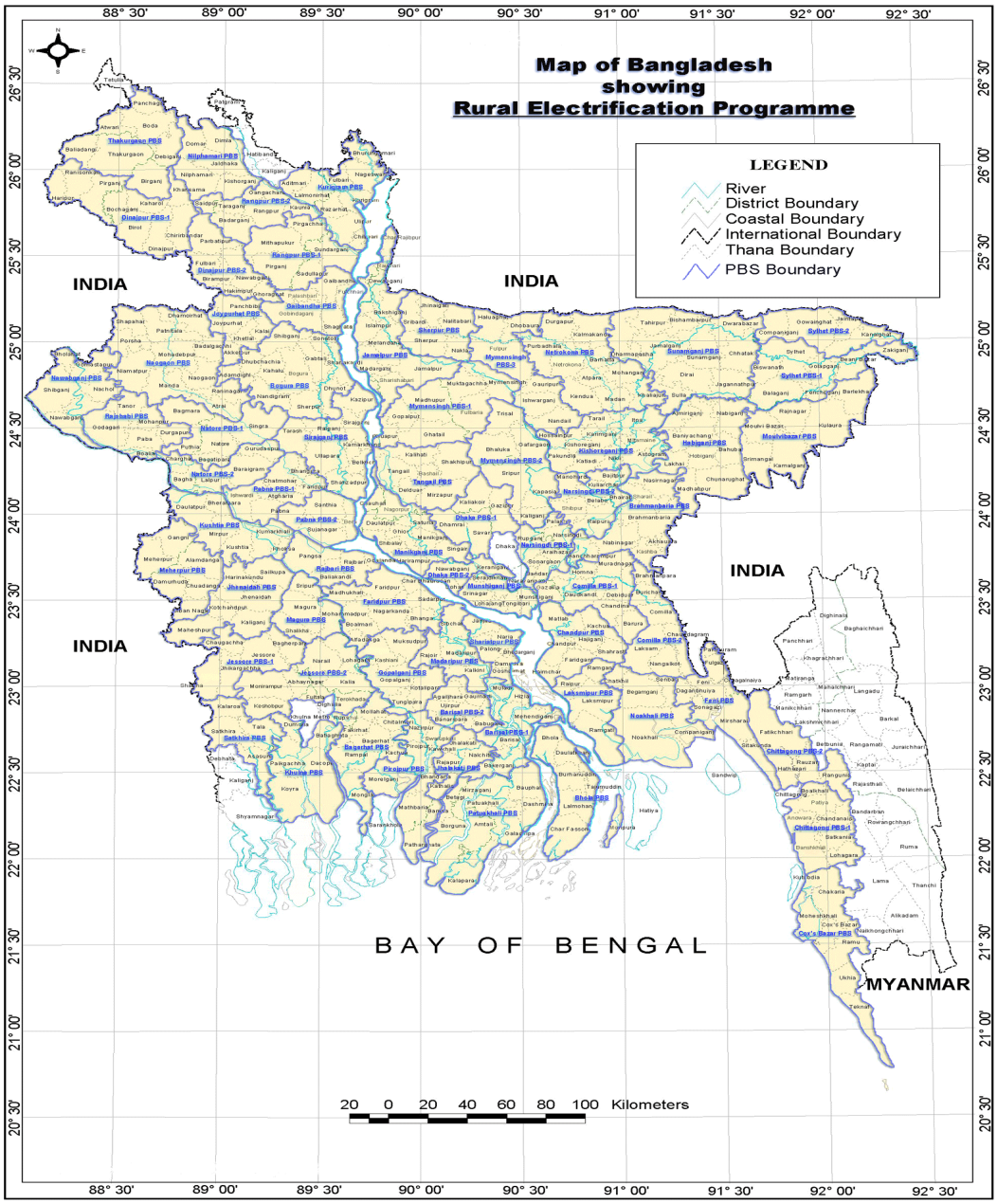


Figure 1: Territorial map of REB (company)

In Polli Bidyut Somity-1 has covered four numbers of the Up-Zillas and these areas are Savar, Dhamray, Kaliakor and Gazipur. And the territorial figure of the PBS-1 which shows in figure 2 and which is given in below: [1]

Figure 2: Territorial map of PBS-1 (company)

1.4 Development of PBS-1 in relation to Socio Economics arena:

During my internship I met few numbers of consumers and discusses about the features of the socio economic development. The mission of the Polli Bidyut Somity is to develop the rural people. In our country, we mainly depend on the agriculture. Most of the rural people are involving mainly on farming or doing small type business. Extension of infrastructure in rural areas is essential for bringing down any meaningful change in the rural living patterns. Before our liberation in the year 1971, we had little facilities that were created for the rural people. Virtually, govt. had little opportunities for expansion of the distribution network in a massive scale. In 1972, Rural Electrification Directorate (under Power Development Board) was established to gear up efforts towards formation of a separate body responsible for electrifying rural areas. In 1976 NRECA conducted a feasibility study for reaching electricity to each and every rural home and other rural establishments. As a result Rural Electrification Board was formed to take up efforts at bringing down changes in rural living patterns. Rural Electric societies have provided jobs to rural families/youths. In addition, a total of 8000 persons are

employed in the construction firms and consulting offices working for the program. Rural people now have much better work-habits and an improved sense of discipline and social security, which came as a result of the assurances of basic amenities in life. In figure 3 proves that they work for social development and this figure is the true statement of their development. [1]

Figure 3: Social Development by REB (company)

Women of the rural areas are enjoying the benefits of electricity very well. They can do extra work after household job and add to family earnings. Women are getting self-dependent, making small groups of income generating purposes, specially rearing poultry and cattle, making vegetable farms & taking-up weaving and sewing projects and opening small shops.

The use of light during evening ensures women's safe movement from one place to another. Electricity has left a profound impact on women's mobility, participation in income generating activities (IGAs), decision-making, freedom of using income and saving, better utilization of credit, knowledge about gender inequality issues, household work plan according to convenience, changes attitude in terms of reducing health care disparities, increase in overall years of schooling for both boys and girls, preference to send girls to schools, awareness of legal issues (i.e., marriage for girls at 18 and boys at 21) and awareness about negative impact of dowry.

They are gaining much more knowledge and thus produce modernization effect. About 15 areas of knowledge disseminated through radio or TV include the value of good health:

- Value of education
- Value of female education
- Utility of family planning
- Development of knowledge-base through news
- Improvement in agriculture practice
- Knowledge of modern fishing
- Knowledge of pest management
- Govt. program for the distribution of Khas land
- Prohibition of dowry
- Laws about divorce
- Legal tools to combat violence against women
- Local governance issues
- Women right issues
- Issues of human rights

Rural Electricity has acted as a leap-forward in the development of commercial activities in rural Bangladesh. Out of the total shops in Bangladesh an estimate 24% are using rural electricity. Electrified commercial establishments are more attached to market. [1]

In agriculture, rural electricity program (REP) has significantly in attaining food self-sufficiency through use of productive and efficient irrigation equipments. Both land use intensity and cropping intensity with electrified pumps (DTW/STW/LLP) is higher than diesel operated. Average yield per acre under electrified pumps is 24% higher than that of diesel operated ones. Electrified pumps contribute one-third of the food self-sufficiency in Bangladesh. REP through its electrified irrigation pumps covers 4.1 million acres of land for HYV Boro and Aman. REP irrigated land produces 6.43 million tons of HYV Boro and Aman, which is about 29% of all similar types of rice, produced in Bangladesh. 20% rebate to the electric bill to the irrigation pumps sanctioned by govt. induces the farmer to enhance the agricultural growth. As agricultural

productivity has increased, availability of rice & other food items in villages have helped rural people maintain better food habits.

A recent USAID study's findings and assessments about impact of the rural electrification program in Bangladesh are the following:-

- Presently 55.41% villages and 5.08 million rural households are electrified and no. of beneficiaries is 30.5 million.
- Literacy rate in the electrified HHs is 71%, where 54% in the un-electrified HHs.
- Electrified HHs use daily 50 minutes more than that of non-electrified HHs between sunset and sleep.
- In the electrified HHs students study 23 minutes more than the non-electrified HHs daily.
- 92.0% reported an increase in amusement as well as standard of living.
- About 68% of currently married women in the electrified HHs reported of using contraceptive methods, where in the non-electrified HHs the rate is 63%.
- 61% electrified HHs use hygiene latrine, where only 29% non-electrified HHs use the same latrine.
- 53% women of the electrified HHs reported allowing young girls/women to work outside the village.
- 71% women of the electrified HHs reported that a couple should have two children.
- Annual energy cost (diesel) saving by all electric pumps $2.41 million by not using diesel.
- Creates 5.06 million direct employment opportunities in the electrified irrigation pumps, industries and commercial shops.

Based on the empirical findings presented above it would be pertinent to conclude that rural electricity has profound and far-reaching economic, socio-cultural and demographic impacts on life and living of the rural people in Bangladesh. It has significant and sustained impact on agricultural growth, industrialization and business and commercial activities. It has an impact on human capital formation through knowledge building mediated through electricity-driven media exposure. Thus, in order to accelerate the process of economic growth, strengthening pro-poor

orientation in the growth process, attain the millennium development goal with an emphasis to PRSP and to further boost up human development in Bangladesh access to electricity of the households and social and economic institutions should be expanded within shortest time.[1]

1.5 Scope and Methodology:

Electricity has a great impact in our national economy and REB is a major distributor of electricity. During our internship we came to know that among 70 Polli Bidyut Somity only PBS-1 makes profit and all other PBS is in loss. One part of my internship was to visit the generation and distribution station of PBS-1.For this purpose I visited Summit Power Plant at Ashulia and United Power Generation & Distribution at Savar EPZ. During my intern at Summit Power and UPGD we observe the generator facts, how they operate, and synchronizing condition of generator, demo diagram of power station and the protection devices, their electricity contribution to REB and how they provide it to the consumers.

I did visited Power Grid Company Bangladesh and their own distribution station to observe the distribution system. For protection purpose REB uses mostly vacuum circuit breaker and for higher safety SF6 circuit breaker on their substations. I also learn about bus bar arrangement, staking design and supervision and other electrical equipment.

I also observe the departments of REB, it has five individual departments. They are Nipor Section, Engineering Section, Member Service, Finance Section and Consultant Service. I observed the revenue collection of the month September which was done by the Finance Department. During this time I also learn about load shedding and how they maintain the schedule of load shedding. This observation helps me to complete my internship and gives me a practical knowledge on electricity generation and distribution.

Chapter-2

Power Generation

2.1 Introduction:

This chapter will focus on power generation of REB. The generation of PBS-1 is covered by Summit Power and UPGD. UPGD covers only Export Processing Zones (EPZ) and rest of the PBS-1 area is covered by Summit Power and by the rationing of PDB. Both of the power plants have rechargeable battery for backup and both of them runs by natural gas. For the overall view of the power station demo diagram is used. Their control system is automatic and highly secured. Both type of pole mounted single phase CT and 11KV CT is used in REB. For safety purpose vacuum circuit breaker is mostly used.

2.2 Power Generation:

REB, accordingly, selected 3 (three) sites, namely Dhaka PBS-1, Narsingdi PBS-1 and Comilla PBS-1 for implementing its 1st phase of Small Scale Power Generation as Pilot Project.Guaranteed Net Plant Capacity of each of the power station is 11 MW. Power generation of said three PBS has already been commissioned. Recently another six IPP has been commissioned.

The power plants details are given below:-

Name of PBS	Name of the Power Plant	Capacity (MW)	Date of Contract	Date of Commercial Operation	Name of Company
Dhaka-1	(i) Ashulia Power Plant (ii) Ashulia Expansion Power Plant	11.00 33.75	10/02/2000 20/03/2006	01/09/2003 04/12/2007	Summit Power Limited
Narshingdi-1	(i) Madhabdi Power Plant	11.00 24.30	10/02/2000 28/06/2005	01/09/2003 16/12/2006	Summit Power Limited

Comilla-1	(i) Chandina Power Plant (ii) Chandina Expansion Power Plant	11.00 13.50	10/02/2000 28/06/2005	01/09/2003 15/11/2006	Summit Power Limited
Narshingdi-2	Norsingdi Power Plant	22.00	11/10/2007	21/12/2008	Doreen Power Generation & & systems Ltd.
Hobigonj	Hobigonj Power Plant	11.00	11/10/2007	10/01/2009	Energypac confidence power venture Ltd.
Sirajgonj	Ullapara Power Plant	11.00	11/10/2007	02/03/2009	Summit Uttaranchol Power Co. Ltd.
Mymensingh-2	Maona Power Plant	33.00	11/10/2007	12/05/2009	Summit Uttaranchol Power Co. Ltd.
Feni	Feni Power Plant	11.00	11/10/2007	25/04/2009	Doreen Power House & & Technologies Ltd.
Narayangonj	Rupgonj Power Plant	33.00	11/10/2007	09/06/2009	Summit Purbanchol Power Co. Ltd.
	Total	225.55			

Table 2: the power plant details of REB (company)

2.3 My Observation:

I did observed that the generation part of PBS-1 was covered by UPGD (United Power Generation and Distribution Company Limited) and Summit Power Limited.

I have learnt that though energy is convenient for alternator, so the heat or sun or any type of energy can be converted into Electrical Energy' that means Electrical Energy converted into Mechanical Energy. There are various types of alternator can be used such as water, coal, diesel, with fuel and without fuel etc. Normally gas, steam, diesel, petrol engine is used in UPGD

(United Power Generation and Distribution Company Limited). There are two power plants in PBS-1 for generating power; UPGD is one of them and another power generation power plant SUMMIT Power also has similar type of generation. Summit Power has increased this plant's production capacity by 33.75 MW with the total output being 46 MW. This project was set up to provide electricity for Dhaka Palli Bidyut Samity-1 less than 100 years Power Purchase Agreement (PPA). An implementation agreement has also been signed with the Government of Bangladesh (GOB). [4]

Lean burn engine is used in UPGD where water reserve is main function of its own. According to gas distribution from TITAS UPGD can supply 22MW to 25MW in Dhaka EPZ. But the total generation capacity is being 41MW. Thus in January 2007 United Power Generation & Distribution Co. Ltd. (formerly known as Malancha Holdings Ltd.) was born out of the necessity for uninterrupted, quality power supply to the industries housed within the Export Processing Zones (EPZ) of Bangladesh. Natural gas is morally used hence because of more available, sufficient and low cost than diesel. The efficiency of diesels engine is greater than efficiency of gas engine. Also diesel engine is big in size otherwise gas engine is small in size so gas engine needs small place. But water engine is more sufficient and we also need low maintenance cost engine. Though technology depends on generation so in steam turbine, waste energy is been reused by combine cycle. [Heat turbine=1/3*capacity of heat turbine]. [3]

Here I have discussed the main feature of the United Power Generation and Distribution Company Limited consists of the total capacity, types of generator they use, when they have started in commercially, number of generators, who are their client etc:

Generator Facts:

Generator Manufacturer: Wartsila (Finland) and Mtube
Generation Capacity per Generator: 8.7 Megawatts and 1.95 Megawatts
Fuel: Natural Gas
Location: Dhaka Export Processing Zone (DEPZ) Plant

Number of Generators: 7
Capacities: 41 Megawatts

Number of Battery: 184
Commercial Operation Date: 26th December 2008
Clientele: Bangladesh Export Processing Zone, Polli Bidyut Somity-1

Now we show the main feature of the Summit Power Limited with consists of the total capacity, types of generator they use, when they start in commercially, number of generators, who are their client etc in given below:

Figure 4: Summit Power Plant, Ashulia [2]

In Figure 4 shows the power plant outlook of the Summit Power Limited and the funding of this power plant is Polli Bidyut Somity-1.

Generator Facts:

Generator Manufacturer: Caterpillar (America) and Wartsila (Finland)
Generation Capacity per Generator: 3.73 Megawatts and 8.73 Megawatts
Fuel: Natural Gas
Location: Asulia, Dhaka
Number of Generators: 7
Capacity: 46 Megawatts

Number of Battery: 110

Commercial Operation Date: February, 2001 and January, 2008

2.4 Demo diagram of power Station:

Demo diagram is required for the overall view of the power station with bus-bar arrangement which shows in figure 5. Every power station has the demo diagram in the station and it will be used in various ways such as it indicates the total feeder number, arrangement of the feeders, transformers, circuit breakers, current transformers, potential transformers etc. This demo diagram provides the plant manager of the UPGD and it is given in below: [3]

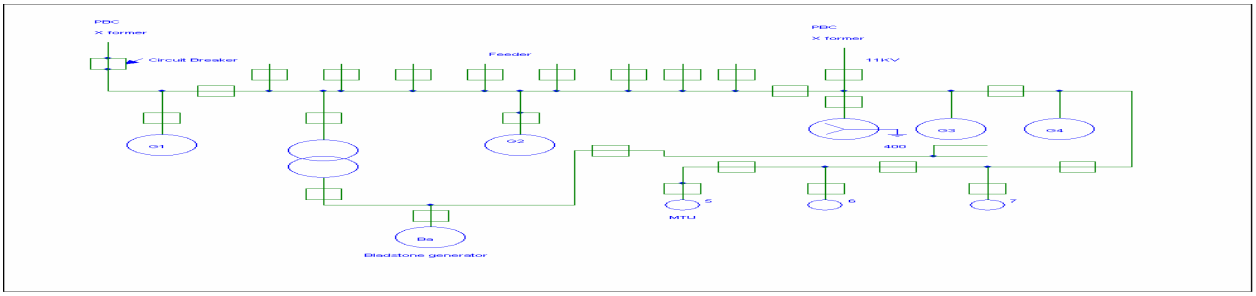


Figure 5: Demo Diagram of the Power Station (company)

2.5 Control panel of power station:

Control panel is an essential part of a power plant. This diagram shows the arrangement of the control panel which is engine, alternator, bus-bar, substation, distribution substation, etc. Now we show the control panel in figure 7 which are given by the plant manager of UPGD:

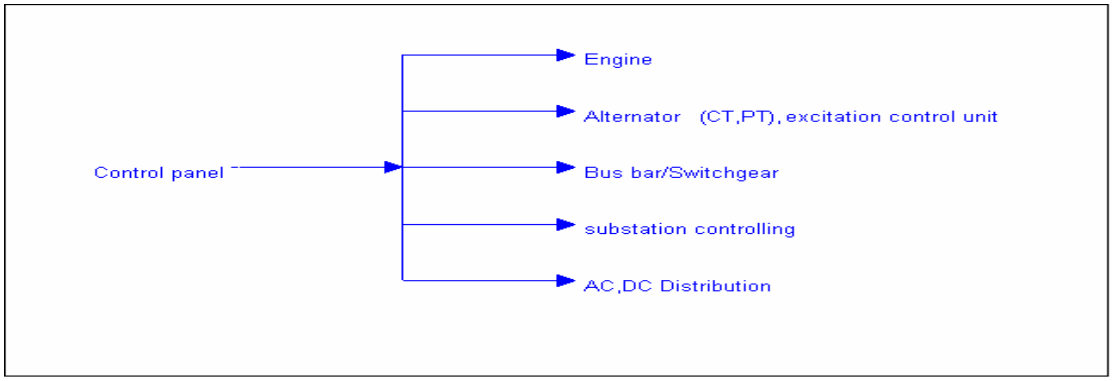


Figure 6: Control Panel of UPGD (author)

DCS: DCS is the scatter system which is used in the power plant. The DCS system consists of distributed process units, procedure I/Os, human-machine interfaces and control software. It monitors and controls these boilers, turbines, thermal auxiliary equipment, generators, transformers and power supply systems. In figure 8 we can see the DCS scatter which is used in REB and only includes AVR, CT (current transformer) and PT (potential transformer).[6]

Figure 7: DCS (Containing AVR, CT, PT) (author)

2.6 Synchronizing condition:

The process of connecting an AC generator (alternator) to other AC generators is known as synchronization and is crucial for the generation of AC electrical power**.** A synchronizer system includes a sequencer which is largely embodied in the digital computer as an element of the automatic control and it further includes a synchronizer which is external to the automatic control. The sequencer connects the synchronizer to synchronize the three generators in a sequence which depends on the startup and loading operation of the turbines, the synchronization operation of the synchronizer and the operation of the breakers. Turbine speed changes are initiated by the speed/load control under synchronizer control. [6]

The alternator must have equal of,

I. *line voltage*,
II. *frequency*,
III. *phase sequence*,
IV. *phase angle*
V. and *waveform*

This is the system to which it is being synchronized. Waveform and phase sequence are fixed by the construction of the generator and its connections to the system, but VOLTAGE, FREQUENCY and PHASE ANGLE must be controlled each time a generator is to be connected to a grid. [6]

2.7 Synchronous generator:

In that unit of control room there was synchronizing frequency display, synchronizing voltage display and synchronoscope, reset button, plant emergency- stop- button and also synchronizing control unit. During my internship I have learn about the parameter of the control unit of the generator. In above I have mentioned that the voltage, phase and frequency will be same as generator unit and bus-bar. The result will be shown with the help of the parameter of the control panel of synchronizing frequency display, synchronizing voltage display and

synchronoscope. Reset button will be need when the system will face any kind of trouble. Plant emergency stop will be needed in an emergency stop of the plant in an emergency case. All the work I had been learning in my internship was with the help of the Summit Power Limited. [2]

In figure 9 I have shown the synchronous generator control unit which is provided by the internship supervisor of the Summit Power Limited is given in the next page:

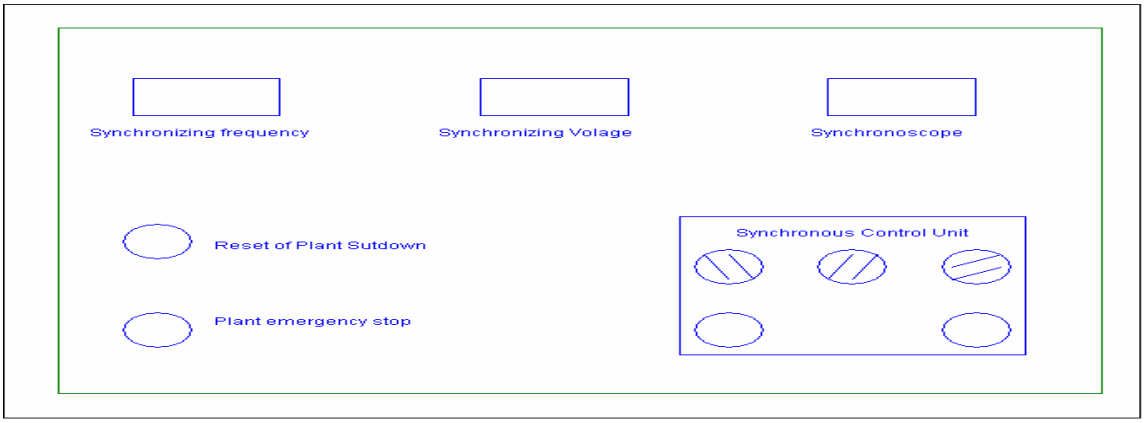


Figure 8: Synchronous Generator Controlling Unit of Summit power plant(company)

Alternator: Alternators are used in UPGD are self excited generator provided from ABB Company. And alternator's frequency is 50Hz, 11kv, 750rpm and power factor is 0.8.

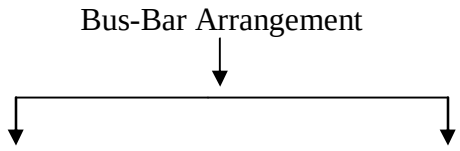
Transformer: There are two 30MVA transformers are used in UPGD which are auto tap change type, are provided from Energy pack supplier of Bangladesh. In transformer there are also spark plug system which creates high voltage, also DC voltage which is converted into AC voltage by pulse leading DC. PLC automatically does tapping of transformer. [3]

2.8 Some other parts of power station:

A control panel is a flat, often vertical, area where control or monitoring instruments are displayed. They are found in places such as nuclear power plants, ships, aircraft and mainframe computers.

- Differential relay: Most differential-relay applications are of the 'current-differential' type.
- PLC: A programmable logic controller (PLC) or programmable controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or lighting fixtures
- Ventilation unit: Generator is used in this unit.
- Rectifier unit: In this unit AC is converted into 110volt and 24volt DC. For 110Volt each of 92 Battery consumes1.5Volt. And for 24 Volt each of 12 batteries consumes 2 Volt. Battery capacity is measured by observing since how much time battery will give amp-hour. All battery is VRLA (Ventilation Lead Acid battery) type. For illustration I have observed that 400 amp-hours give 24 Volt and 120 amp-hours give 110 Volt. In that unit variable frequency diode used for varying frequency to change rpm (rotation per minute).[1]

Switchgear: The term switchgear, used in association with the electric power system, or grid, refers to the combination of electrical disconnects, fuses and/or circuit breakers used to isolate electrical equipment. Switchgear is used both to de-energize equipment to allow work to be done and to clear faults downstream. Here Bus-Bar Arrangement is shown in below by a diagram of load division in switchgear:



400 Volt — 11 Kilo Volts

In Low Voltage Side — In High Voltage Side

From the diagram of load division we see that main Bus-Bar Arrangement (BBA) is divided into two side's .Where 400 Volt in Low Voltage Side and 11 Kilo Volts in High Voltage Side. [6]

- Circuit Breaker (CB): Most of the circuit breaker is vacuum circuit breaker but SF6 circuit breaker is used in Alternator side (Wartsila Finland) because of more safety.
- NGR (Natural Grounding Resistance).
- PPE (Personal Protective Equipment): Such as heal mate, ear-protection, and glass.
- Fire Protection: Fire, water, fire extinguisher.

MTU: Engine control panel capacity 548degree centigrade.

Auxiliary control panel: Wartsila (Finland) engine consume 500 degree centigrade.

Radiator: In figure 10 I have shown the radiator which is captured in UPGD. In radiator there are 24 fans are used in radiator unit. Where 24 fans are arranged in three columns and each column consumes 8 fans to bring out hot air for cooling purpose. Radiator always ensure that the maximum cooling of the generator which I have learn in from my internship.

Figure 9: Radiator with 14 fans at UPGD [3]

Though SUMMIT POWER and United Power Generation and Distribution Company Limited (UPGD) cover the generation part of REB (Rural Electrification Board) .So SUMMIT POWER provides 46 MW for REB. Each four engine consumes 8.73MW individually and another three engines also provide 3.73MW each generator. Hence most of the Circuit Breakers are provided from Energy Pac. At first, 2000 SUMMIT POWER provides 11MW for REB later in 2008 this supply capacity was extended to 35MW. Diesel engines are provided form Italy are Wartsila (Finland) type which is used to their own service. 33KV engines are purchased from

SIMENSE Company. In sub-station, transformers are also used for tapping purpose of 33KV side to 11KV side. If 11KV side reduces at 9KV then by tapping it is done 11KV by transformer.[6][4]

Actually generating power plant of UPGD and SUMMIT POWER are same from constructional view. Hence also Radiator unit and there 48 fans are used. Those 48 fans are arranged in six columns and each column consumes 8 fans to bring out hot air for cooling purpose also. All battery is provided from Rahimafrooz Company Limited. All battery is used for engine controlling in load shedding condition.

2.9 Conclusion:

Lean burn engine is used in UPGD where water reserve is main function of its own. According to gas distribution from TITAS, UPGD can supply 22MW to 25MW in Dhaka EPZ. But the total generation capacity is being 41MW. Summit Power has increased this plant's production capacity by 33.75 MW with the total output being 46 MW. There are two 30MVA transformers are used in UPGD. Alternators are used in UPGD are self excited generator provided by ABB Company and alternator's frequency is 50Hz, 11kv, 750rpm and power factor is 0.8. Most of the circuit breaker used in this power plant is vacuum circuit breaker but SF6 circuit breaker is used in Alternator side (Wartsila Finland) because of more safety.

Chapter-3

Power Distribution

3.1 Introduction:

This Chapter will focus on the distribution side. Substation is used for distribution purpose. To establish a substation, there are some important points which have to be maintained. Different types of substations are used to meet the different requirements. Normally step-up substation is used at end of the generator side. Circuit breaker is protective element used in substation to avoid the abnormal situation. Arrester and earthing is also used to avoid the overcharging situation. Current transformer, potential transformer and bus bar arrangement are the common feature of distribution substation. Typically, transformer is used to ensure the electricity supply in both end of the substation and the household.

3.2 Power Distribution:

Electricity distribution is the final stage in the delivery of electricity to end users. A distribution system's network carries electricity from the transmission system and delivers it to consumers. Typically, the network would include medium-voltage (less than 50 kV) power lines, electrical substations and pole-mounted transformers, low-voltage (less than 1 kV) distribution wiring and sometimes electricity meters.

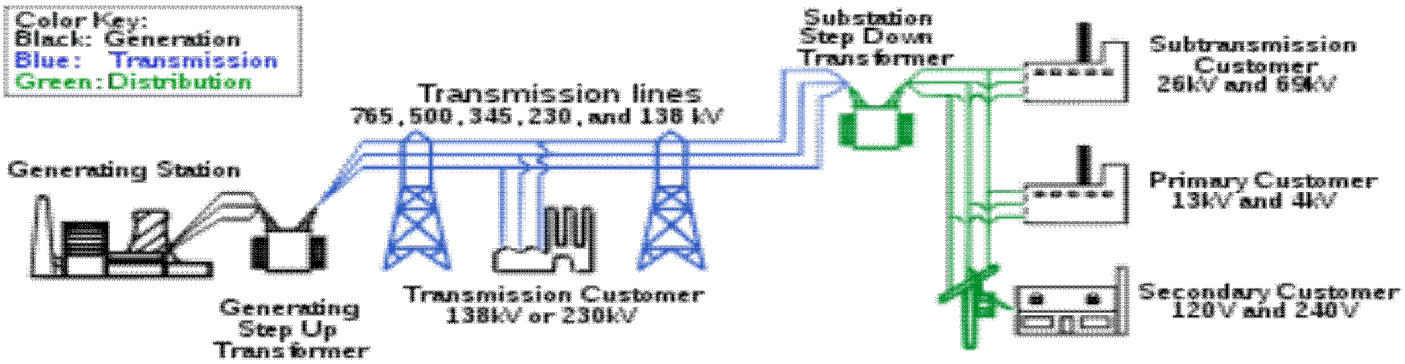


Figure10: Power Distribution (generation to consumer end) (company)

The same phenomenon is applicable for REB. At first power come to the Grid Station (415 kv) from National Grid, then power transmitted to the substation (33/415kv). From substation power is transmitted to the bus bar (11/33kv) and then to the consumer through transformer. [5]

3.3 Substations:

The assembly of apparatus used to change same characteristics of electric power supply e.g voltage, ac to dc; frequency etc is called a substation. Substations are important part of the power system. The continuity of supply depends to a considerable extent upon the successful operation of substations. It is, therefore, essential to exercise utmost care while designing and building a substation. There are some important points which must be kept in view while lying out of a substation. These points are given below:

- It should be located at a proper site. As far as possible, it should be located at the centre of gravity of load.

- It should be provide safe and reliable arrangement. Due to safety, consideration must be given to the maintenance of regulation clearances, facilities for carrying out repair and maintenance abnormal occurrences such as possibility of explosion or fire etc.
- It should be easily operated and maintained.
- It should be involve minimum capital cost.[7]

3.4 Transformer Substations of PBS-1:

The majority of the substations in the power system are concerned with the changing of the voltage level of electric supply. Transformer substations are four types depending on the purposed or used. Classification of these transformer substations are given below: [8]

- **Step-up Substation:** Step-up substation is being situated at end of the generator side. In my internship I had visited two power stations. Both of the stations supply 11KV at end of the generator side.
- **Grid Substation:** From the step-up substation, electric power at 220KV or 132KV etc. is transmitted by 3-phase. 3 wire overhead system to the outskirts of the city. Here electric power is received by the primary grid substation which reduces the voltage level to 66KVor 33 KV or any another type for secondary transmission. Generally grid substation is of outdoor type.
- **Secondary Substation:** From the grid substation, electric power is transmitted at 66 KV or 33 KV or ant another type by 3-phase, 3-wure system to various secondary substations located at the strategic points in the city. At a secondary substation the voltage is further stepped down to 11 KV. The 11 KV lines run along the important road sides of the city. It may be noted that big consumers are generally supplied power at 11 KV for further handling with their own substations. The secondary type substations are also called outdoor type substations.
- **Distribution Substation:** The electric power from 11 KV lines is delivered to distribution substations. These substations are located near the consumers' localities and to 400V or 230V. 3-phase or 4-wire for supplying to the consumers. The voltage between any two phases is 400V and the voltage between any phase and neutral is 230V.

Equipment of the Grid Substation:

The equipments required for a substation which depends on the type of the substation and service requirements. However a transformer has the following equipments. These equipments are described in the given below: [8]

- **Bus-bars:** Bus-bars are necessary when multi lines are operating at the same voltage have to be directly connected electrically; bus-bars are used as the common electrical component. All the bars are copper or aluminum bars. All the incoming and outgoing lines are connected to the bus-bars.

Figure 11: Bus-Bar of Substation (double bus bar arrangement) (author)

In figure 14 shows the bus-bar which is necessary because it consists of incoming line and outgoing line. And it is needed to transmit the electricity through the one end to another. There are 3(three) types of the bus-bars arrangements. According to the theory types of the arrangements of the bus-bars is given below: [8]

- **Single bus-bar arrangement:** In figure 13 consists of a single bus-bar and all the incoming and outgoing lines are connected to it. Initially is low cost arrangement, less maintenance and simple operation. If there is a fault then the total system is affected by it.

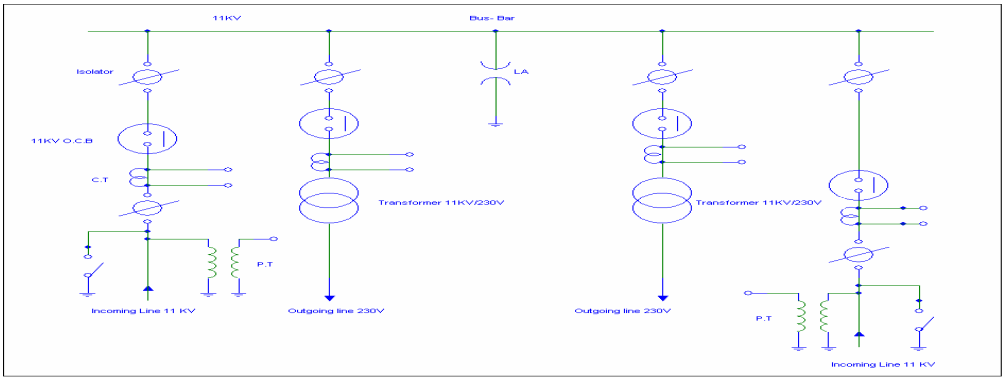


Figure 12: Single Bus-Bar Arrangement [8]

❖ **Single bus-bar system with sectionalization:** The single bus-bar arrangement is divided into section and load is equally distributed on all the sections. Between two sections connected with circuit breaker and isolator which is showing in figure 14.

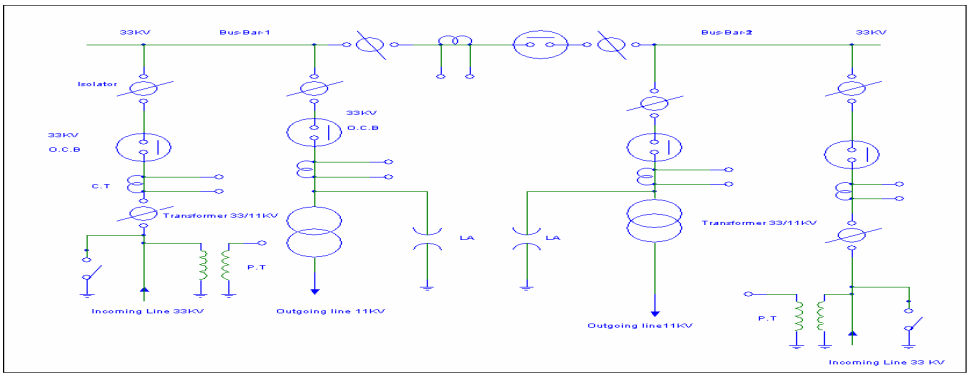


Figure 13: Single Bus-Bar system with Sectionalization[8]

❖ **Double bus-bar arrangement:** In figure 15 double bus-bar arrangements consisting of the two bus-bars, a main bus-bars and a spare bus-bar. Incoming and outgoing both have multi-line bus-bars, they are connected in separates lines.

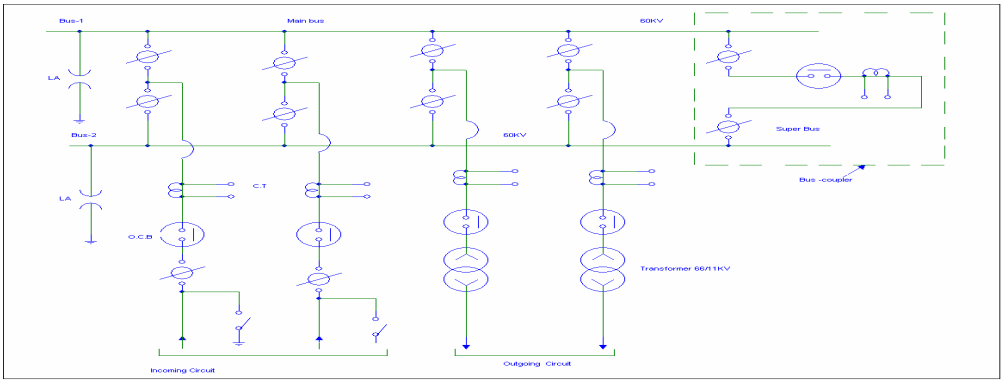


Figure 14: Double Bus-Bar Arrangement [8]

In PBS-1 all kinds of substation are double bus-bars arrangements what I have seen. Grid substation of the Hamannogor, Savar has also the double bus-bars arrangements. Double bus-bar arrangement has the main advantage is that if any of the bus has occurred in a fault then there is no effect to other bus at that time so that all of the consumer is not affected to the fault. PBS-1 has used this advantage as far as I have seen

- **Insulators:** We know that the insulator serves two purposes. One is they support the conductors (or bus-bars) and confine the current to the conductors. In my internship I have seen porcelain insulator which is the most commonly used material for the manufacture of insulators is porcelain. There are several types of insulators (e.g. pin type, suspension type, post insulator etc.). And their use in the substation will depend upon the service requirement. For example, post insulator is used for bus-bars. A post insulator consists of a porcelain body, cast iron cap and flanged cast iron base. The hole in the cap is threaded so that bus-bars can be directly bolted to the cap.
- **Isolating Switches:** In substation, it is often desired to disconnect a part of the system for general maintenance and repairs. This is accomplishing by an isolating switch or isolator. An isolator is essentially a knife switch which is designed to open a circuit under no load. In other words, isolator switches are operated only when the lines in which they are connected carry no current.
- **Circuit Breaker:** A circuit breaker is equipment which can open or close a circuit under normal operation as well as fault condition. In Hamannogor grid substation, all the circuit

breaker is SF6 type. In closed position of the breaker, the contacts remain surrounded by SF6 gas and the pressure of the gas is 2.8 kg/cm². When the breaker operates the pressure of the gas is goes to 14kg/cm². We know that the high pressure flow of SF6 can absorbs the free electron easily. During my internship I know that the pressure of the SF6 circuit breaker are 2.8 kg/cm² in normal condition of the circuit breaker and the abnormal condition this pressure rise to the 14kg/cm². If the pressure goes down then the circuit breaker do not able to do proper work and it may be risky for the whole system and also it is dangerous to system protection. This kind of circuit breaker is costly because of the high cost of the SF6 gas. But it is environment friendly because it cannot deposit the high amount of carbon. And it also low maintenances cost and the light foundation requirement. Over all in this grid substation has ensure that the protection is valid and it is user friendly.

- **Power Transformers:** A power transformer is used in a substation to step- up or step down the voltage. It is important part for a substation; I have also mentioned that power transformer is required for any type of substation. Except at the power station, all the subsequent sub- station use step- down transformers to gradually reduce the voltage of electric supply and finally deliver it at utilization voltage. The modern practice is to use 3-phase transformers in substation, although 3 single phase bank of transformers can also be used. The use of 3-phase transformer (instead of 3 single phase bank of transformers) permits two advantages. Firstly, only one 3 phase load tap changing mechanism can be used. Secondly, its installation is much simpler that the three single phase transformers. I know from my internship the power transformer is gradually installed upon lengths of rails fixed on concrete slabs having foundation 1 to 1.5 m deep. For rating up to 10 MVA, naturally cooled, and also forced air immersed transformers are used. For higher ratings, the transformers are generally normal and forced air cooled.
- **Instrument Transformation:** In the grid substation, the main lines in sub-station operates at high voltage and carry current of thousand of amperes which we have seen. The measuring instruments and protective devices are designed for low voltage (generally 110V) and currents (about 5A). Therefore, they will not work satisfactorily if mounted directly on the power lines. This difficulty is overcome by installing instrument transformers on the power lines. The function of these instruments of these instrument transformers is to transfer voltage

or currents in the power lines to values which are convenient for the operation of measuring instruments and relays. There are two types of instrument transformation viz.

- Current Transformer (C.T)
- Potential Transformer (P.T)

Current Transformer (C.T.): A current transformer in essentially a step-up transformer which steps down the current to a known ratio. The primary of this transformer consists of one or more turns of fine wire and provides for the measuring instruments and relays a current which is a constant fraction of the current in the line. Suppose in the Hamannogor grid substation, a current transformer rated at 100:5 A is connected in the line to measure current. If the current in the line is 100 A, then current in the secondary will be 5A. Similarly, if current in the line is 50A, then secondary of C.T. will have a current of 2.5 A. Thus the C.T. under consideration will step down the line current by a factor of 20.

Voltage Transformer (P.T.): It is essentially a step down the voltage to a known ratio. The primary of this transformer consists of a large number of turns of fine wire connected across the line. The secondary winding consists of a few turns and provides for measuring instruments and relays a voltage which is a known fraction of the line voltage. Suppose in the Hamannogor grid substation, a potential transformer is rated at 132KV/33KV is connected to a power line. If line voltage is 132KV, then voltage across the secondary will be 33KV.

➢ **Metering and Indicating Instrument:** There are several metering and indicating instruments (e.g. ammeters, voltmeters, energy meters etc.) installed in a sub-station to maintain watch over the circuit quantities. The instrument transformers are invariably used with them for satisfactory operation what we observed during our intern.

➢ **Miscellaneous Equipment:** In addition to above, there may be following equipment in a substation which we also see:

- Fuses
- Carrier-current equipment

- Substation auxiliary supplies

3.5 Arrester and Earthling:

In a grid substation lighting arrester, absorber and earthing are important factors for protecting it. Lighting arrester or surge diverter is a protective device which conducts the high voltage surges on the grid substation to the ground. These devices work under three conditions. These three conditions are given here. Under normal operation, on the occurrence of the over voltage and non linear operation of the arrestor are the three different conditions. And there is various type of the lighting arrestor which we use in different purpose of the grid substation. Lighting arrestor are five types and these differences are only possible for constructional details. With respect to the difference, the main purpose of the lighting arrestor is same but there we have some advantages and disadvantages which I have describe below in tabular from: [8]

Name	Description
Rod type arrestor	Very simple type and consists of the two rods. One is connected to the circuit and another is connected to the earth.
Horn type arrestor	Consists two rods with a small air gap. One of the ends is connected to the line through resistance and inductor on the other hand another end is connected to the ground.
Multigap arrestor	Consists of a series of metallic cylinders insulated from one another and separated by small intervals of air gaps.
Expulsion type arrestor	Also called protector tube and used in mainly operating upto 33KV.
Valve type arrestor	Important for non linear resistors and operating at high voltages.

Table 3: Description about different type Arrester

In Hamannogor grid substation, horn type arrestor had been used which I observed. Horn type arrestor has two separate horns. The horns are so constructed that distance between them gradually increase. Both the horns are porcelain type insulators. It has a resistance and inductor or coil so that it helps to follow the limiting current through the resistance. During the intern I

have observed some advantages and limitations about the horn type arrestor. This type arrestor will be able to the self clearing arc and series resistance will be able to pass the limited current. On the other hand we know horn type arrestor have also some disadvantages. The setting of horn gap is likely to change due to corrosion or pitting and it has adverse affects on the performance of the lighting arrestor. Operation time is comparatively long, which I mention that around three seconds. Surge absorber is also a protective device which reduces the steepness of wave front of a surge by absorbing surge energy. Now we show the block diagram of the horn type lighting arrestor is given below with the help of the figure 16:

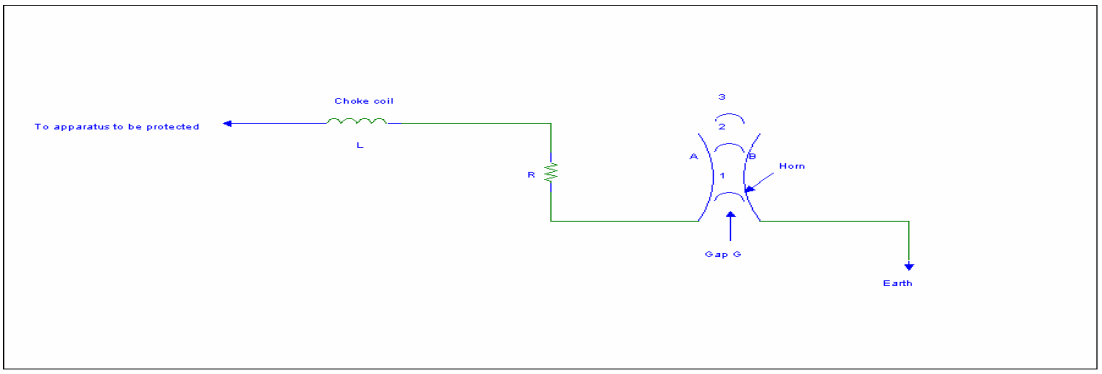


Figure15: Lighting arrestor

3.6 Conclusion:

The electric power from 11 KV lines is delivered to distribution substations. These substations are located near the consumers' localities and to 400V or 230V, 3-phase or 4-wire for supplying to the consumers. The voltage between any two phases is 400V and the voltage between any phase and neutral is 230V. For safety purpose in grid station SF6 circuit breaker is used and to avoid overcharging horn type arrester is used. All the substations REB uses double bus bar arrangement, because in single bus bar system for any type of fault total system gets affected.

Chapter-4

Distribution Substation

4.1 Introduction:

Distribution substation has a great impact on the electricity distribution of Polli Bidyut Somity-1. Through distribution substation voltage level is maintained. Staking design and supervision is also very important for both the consumer and REB for proper service distribution. This department concern with appropriate designing of new connection and analyses the system loss of REB. By proper functioning of this department user get their deserved connection. As the supply is almost half of the demand, the authority has to do load shedding. For this purpose the authority of REB have to maintain a load shedding schedule.

4.2 Distribution Substation:

During my internship I have visited two distribution substations which are located in the main yard of the polli bidyut somity-1 and Dhamrai. For both of this two distribution substation, 33KV voltages come from the step-up transformer and it reduced the voltage level to 230V. There are 19 distribution substations and these substation are out of this. In this two distribution substations Here I see the PT (Potential Transformer) rating 33KV:240V and this rating is fixed in the substation. And also I have observed the CT (Current Transformer) rating 150:5 which is variable. There are two distributing unit and the capacity of one of these unit is 20MW and the unit capacity is 10MW in each of them. Here the entire transformer is single phase and the number of the transformer is 6. We know in here the rating of the power transformer is 3.33 MVA. In REB whole the distribution system with line is Y connected. Here I see the use of the voltage regulator. Voltage regulator 10% voltage increases or decreases of the whole system and I also use the filter valve, filter valve is used to see level of the oil. Oil is an important factor of the transformer and transformer oil must be changed when it could be smashed. Temperature of the transformer must be below 60ºC because the protection. For 33KV bus-bar we need to 6 lighting arrestor and all of the lighting arrestor is horn type. In a substation there are more than 4 numbers of feeders but in this substation there are 6 feeders because of the good service providing. In figure 17 we have been shown the block diagram of the distribution substation. This figure consists of the circuit breaker which is operated by SF6 gas, bus-bar which is double

bus-bar arrangement, CT, PT, power transformer etc all this information will be provided by the internship supervisor during my internship. Now I have mentioned the figure below: [1]

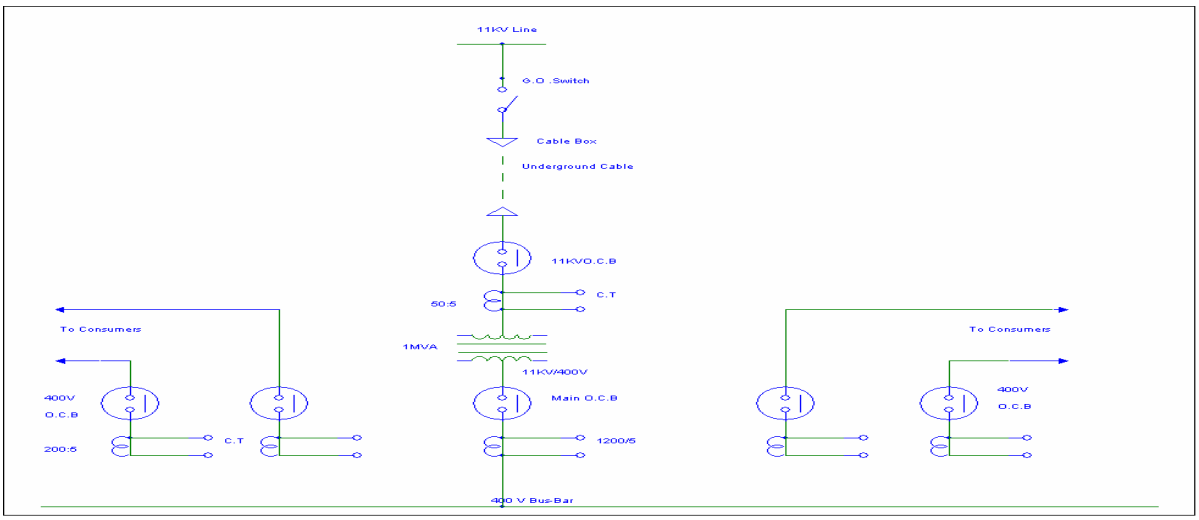


Figure 16: Typical View of Distribution substation (company)

Now we show the overall view of the distribution substation in figure 18 and consisting parameter description in the page:

Figure 17: Overall View of the Distribution Substation (author)

Already I have mention that the in distribution substation they use single phase transformer and these transformer is manufactured by the Toshiba Company and now we show the nameplate of these transformer.

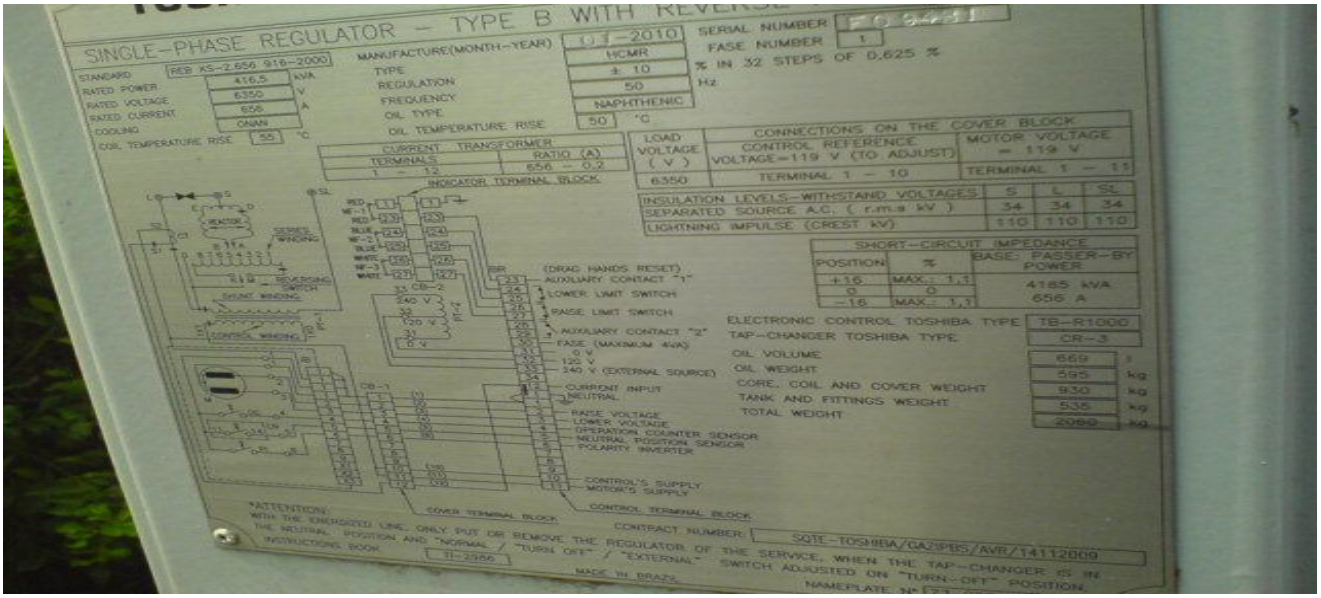


Figure 18: Nameplate of the Transformer (author)

4.3 Staking Designing and Supervision:

Staking design and supervision is an important part of the PBS-1 for both the consumer and the somity. It is need to the somity for distributed the proper service and it is helpful for update the behavior of the organization. Staking and supervision department is working for the constructing the new lines and design department also works for design the new line or new area or to provide the best service. Sectionalization of the line and to create the road map for the new consumer is also responsibilities for the staking department. To set up the fuse and ACR in the line & to ensure the same voltage we establish the voltage regulator in the line which has also responsibilities of the staking department. Suppose there are 8 consumers the distance of the transformer is 200foot. So that there is possible power factor and voltage drop will measured by this process

8*200 foot = 1600A.Foot

We know from here, V= IR = IL [here L=R; L=length]

So that V= 1600A.Foot / 1950 = 0.8 [here 1950=constant]

Theoretically possible power factor will be 0.8 but voltage drop might be increase to 11V and in LD it would be 9.2V. Calculate the voltage drop is the important work for this section and it directly related to the consumer premises. This department also studies the system loss of this samity. Now we show the system loss flow chart (percentage vs year) from 1981 to 2009 is given below in figure 20: [1]

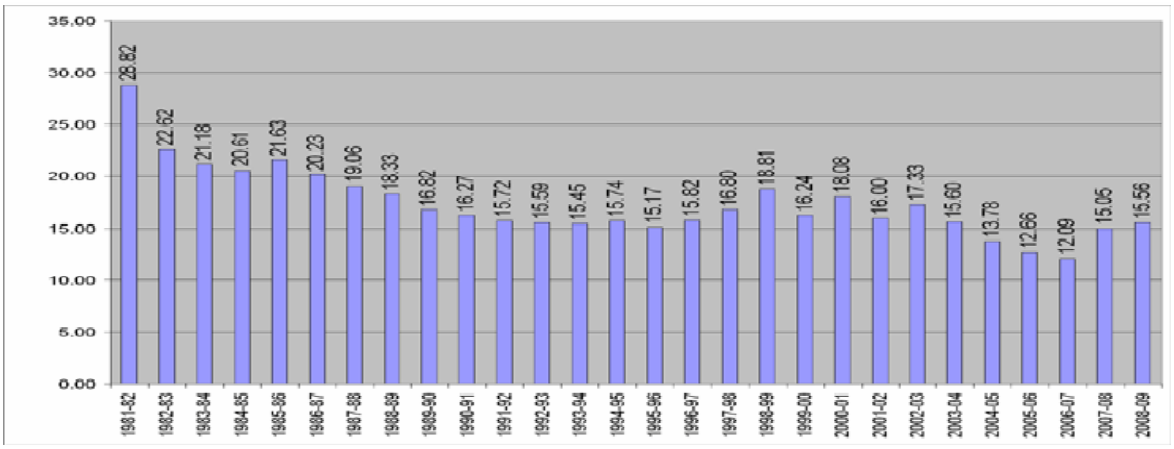


Figure 19: System Loss Chart (company)

The data of this chart we collect from the polli bidyut somity. This system loss is depending on the many other things such as technical loss, over load loss, cross section loss etc.

4.4 Load Shedding:

Now we see the average load shedding of month December, 2011 at different time with the help of the table 7 consists of demand and supply is given: [1]

Serial	Time	Demand	Supply
1	1.00 AM	3.953 MW	2.960 MW
2	5.00 AM	3.405 MW	3.405 MW
3	10.00 AM	4.980 MW	2.858 MW
4	17.00 PM	5.225 MW	2.703 MW
5	20.00 PM	5.515 MW	2.523 MW
6	23.00 PM	5.430 MW	2.567 MW

Table4: Load Shedding Information of December, 2011 (company)

Now we see column chart for the load shedding in gig watts with the help of figure 21. Here series1 represents that the load demand and series2 represents the total supply in the month December, 2011.

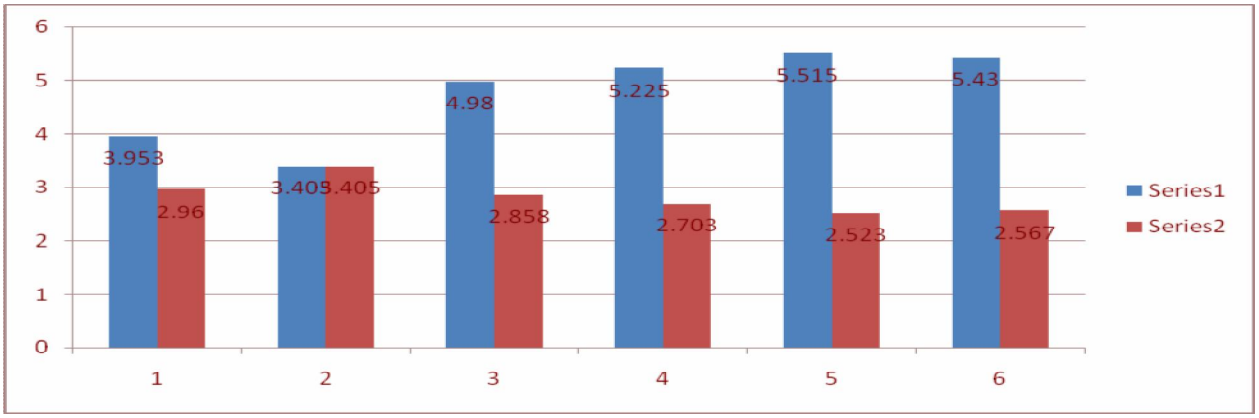


Figure 20: Load Shedding Scenario in December, 2011(company)

4.5 Conclusion:

Through this chapter I have learn about the distribution substation. In distribution substation 33KV voltage is reduced to 230V for the consumer's end and the rating of CT and PT used in the distribution substation is 150:5 and 33KV:240V which is variable. To provide a connection it is very important to calculate the power factor and voltage drop which is done by the staking design and supervision department and I have also learn about the system loses of REB. Because of less resource and as the supply is almost half of the demand we have to face the load shedding problem.

Chapter 5

Other Departments of REB

5.1 Introduction:

To operate properly an organization needs different departments. This chapter will focus on the departments of REB, their duties and responsibilities. To get a connection or line from REB consumer have to maintain few procedure which is maintained by these departments. REB also provides the maintenance and repairing service to their existing user. REB also makes their user conscious about fair uses of electricity as they have limited supply of electricity.

5.2 Other Departments of REB:

During my internship I have learn various kinds of other activities. The Polli Bidyut Somity-1 has the five sections of their other activities which are learning during my internship. All the activities are interred related to each other. All sections are responsible to run somity. In the internship I have worked in these sections and have tried to learn how they work or how they organize it. Now we describe these sections in given below:[1]

- **Nipor Section:** In nipor section, all staffs are working together for maintaining the line and for constructing the line. Maintenance and construction is the main requirement for purchasing a connection. When a consumer receives the line or connection then he or she became a member of the somity. Then he or she is also responsible for preserving the line.
- **Engineering Section:** In engineering section, I have learned how they investigate the constructing line and also they supply the necessary equipment for the consumer to get connection. This section also records the system loss information and the information of the peak demand. They also record the total receiving power from the grid substation and also distributed power. Damaged transformers also repair from this section. Repairing transformer and supply the new transformer to the consumer or distribution substation is also the major responsibilities for

the engineering section. Engineering section also works for sudden accident when it happens and ensures the best solution as early as possible. Load dispose center also works under this section. Engineering department estimates how long the line will be constructed for relevant year and they pass their estimate to their higher authority. The entire engineer and the staff will work together as their target. Polarity testing and the required number of the pole supply will the responsibilities of the engineering section. In here we can see the figure 22 how they repair the transformers and filled up the oil in the transformers:

Figure 21: Repairing Transformer at PBS-1 (author)

- **Member Service:** Member service is most important part for the somity as far as I know when I went to the internship. The member somity had been established at one point service center. In the one point service center a member will solve their any kind of problem which they face. One point service is too much effective for a consumer because they do not face any problem to solve a problem and also it is time saving service for a consumer. In one point service, all the worker of this section is motivated to serve properly. Increasing member is also the responsibilities of the one point service.
- **Finance Section:** Finance department is working to collect the bill from the consumer and they also record the total earning revenue from the consumer. In finance section they also determine the bills per unit. In below, we can see the table that consists of the number of

different types of consumer, total different type revenue of Decembar,2011 month and the percentage of the total revenue of this month:

Contents	Class of Service	Number of the Connections	Amount of the Revenue	Percentage of the total Revenue
1	Domestic	1, 42,959	77,513,781	29.63%
2	Commercial	18,769	26,158,667	10%
3	Irrigation	3823	803,727	0.31%
4	Charity Organization	1507	1,057,405	0.404%
5	General Power	4489	91,690,070	35.05%
6	Large Power	83	32,551,135	12.44%
7	Street Lights	183	40,094	0.02%
8	Resale to other PBS	0	31,787,119	12.15%
	Total	1, 71,768	261,601,998	100.004%

Table 5: Total Revenue of the month Decembar, 2011(company)

Now we show the pie-chart of the percentage of the total revenue of Decembar, 2011 in following figure where it consists of the percentage of the total revenue and these data was be taken from the previous table

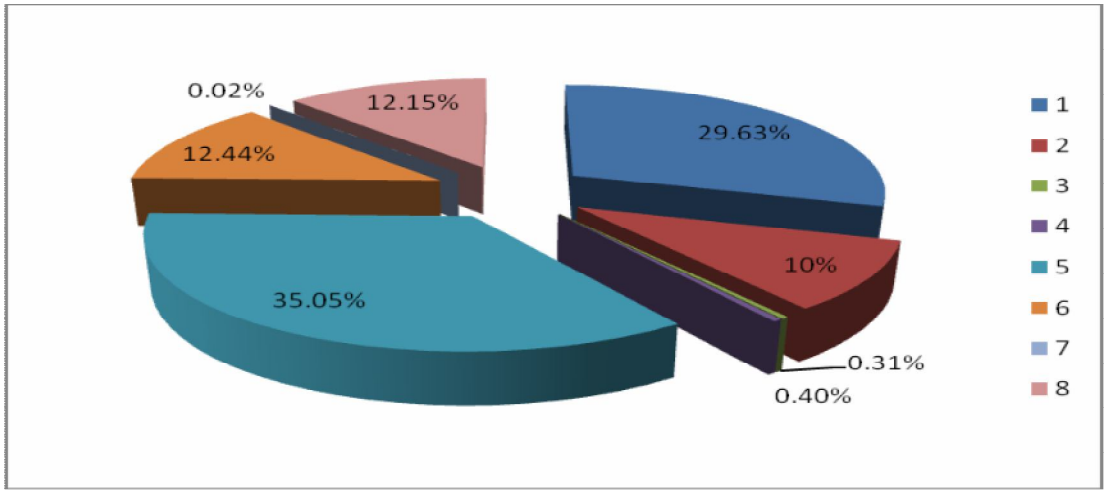


Figure23: Chart for total revenue collection (company)

➢ **Consultant Service:** Consultant department works transparently because it is responsible for other works. This section calculated and receives the extra equipment for doing their running project. If this department is refused any kind of bill so that they cannot able to collect the bill from the finance section. This section cannot pass any bill without proper investigation and proper authorization reference. Future master planning and field survey will be held under the consultant section. Consultant department calculate the number of the member when a new line will be constructed. [1]

5.3 Conclusion:

At the end of this chapter we came to know that to operate properly REB has five different departments. If any client wants a line or connection from REB they have to come to the consultant service department. After investigation if Consultant Service gives the permission then Nipor Section construct the line. Load shedding schedule and maintenance is done by the Engineering Department and the revenue collection is done by the Finance Department. Member Service provides service to their existing consumer.

Chapter 6

Personal view

6.1 Problems and Recommendation:

I have completed my internship on 27th November 2010. During my intern ship I came to know that REB faces lots of problems and they also have some limitations. Transformer stealing is one of the major problems of REB. Criminals stole 13 transformers of Moulvibazar Palli Bidyut Samity (PBS) in last two months, causing immense sufferings to the consumers of electricity in rural areas of the district. In July, five transformers were stolen from Shaymerkuna, Ashia, Mukundapur and Kamalpur areas of Moulvibazar Sadar upazila and Baramchal of Kulaura upazila, according to the PBS officials. Now REB is strict to stop this type of crime, according to the rules and regulations of the PBS, the transformer is provided free of cost at the

time of opening electricity supply in any area. If transformer is stolen from an area for the first time, the authority is to pay 50 percent and the consumers concerned are to pay the rest for installing a new transformer. But in case of a stealing for the second time and afterwards, the consumers have to make full payment for a transformer to resume electricity supply, and for commercial use the concern company have to purchase the transformer from the opening of electricity supply. They also need social awareness to stop this crime.

During my internship I was unable to learn that how much gas is required to produce one MW electricity which was my limitation. To complete my internship and to understand the technical terms properly Power System Protection and Power Station these two courses helped me. So if someone wants to do internship at REB, they need to complete these two courses and stay in REB's quarter and it will be better if they choose it after completion of there all academic courses.

6.2 Conclusion:

At the end of my internship I want to say that the REB (Rural Electrification Board) is the semi-autonomous government agency reporting to the Ministry of Power Energy and Minerals Resources, which was responsible for electrifying rural Bangladesh. REB is charged with the responsibility to provide financial support, technical oversight, and long-term direction to the rural electrification program in Bangladesh. There are foreign and local electrical consultants working in PBS. Though REB takes generation from Summit Power Limited and United Power Generation and Distribution Company Limited and grid supply from PGCB (Power Grid Company Bangladesh), So REB has commitment with those company for supplying Power. However, although we have huge lack of electricity in Bangladesh but all of generation, Grid supply, sub-station, consultancy, local member service of REB is more efficient and taking important role to cover lack of electricity.

Appendix A

Acronyms

REB	Rural Electrification Board
GDP	Gross Domestic Product
GOB	Government of Bangladesh
KWh	Kilo-Watt-Hour
KV	Kilo-Volt
MW	Mega Watt
PBS	Polli Biddut Somity
PBS-1	Polli Bidyut Somity-1
PDB	Power Development Board
PGCB	Power Grid Company Bangladesh
UPGD	United Power Generation and Distribution Company Limited
PT	Potential Transformer
CT	Current Transformer
LD	Load Division
LA	Lighting Arrestor

- IGA Income Generating Activities
- EPZ Export Processing Zones
- AVR Automatic Voltage Regulator

Appendix B

References:

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