Study On Tariff & Energy Audit Of DPDC (DHAKA POWER DISTRIBUTION COMPANY LIMITED)

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

Submitted By
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DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
FACULTY OF ENGINEERING
DAFFODIL INTERNATIONAL UNIVERSITY

JANUARY -2020

LETTER OF TRANSMITTAL

20 January, 2020

A.N.M Nazmul Haque

Executive Engineer

Dhaka Power Distribution Company Ltd.

Sub: Submission of the Internship Report.

Dear Sir,

It is a great pleasure to submit my report prepared by me during my internship in Dhaka Power Distribution Company Limited (DPDC).The internship provided me great opportunity to experience the real life development environment, modern technology and techniques.

I hope that it will ensure positive role in the development of my future career. In this report, I tried to summarize what I have done and experienced during my internship period in Dhaka Power Distribution Company Limited.

I am really lucky to have the chance to take part in this internship program. I express my sincere gratitude and thankfulness to my co-supervisor **K.B.M Rakib Hasan** for guiding me continuously for the successful completion of the internship report.

Thank You.

Yours sincerely,

Md. Zahid Hasan

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Md. Yasin Arafat
ID: 163-33-3659

Department of Electrical and Electronic Engineering, Faculty of Engineering.

Approval letter

ঢাকা পাওয়ার ডিস্ট্রিবিউশন কোম্পানি লিমিটেড
DHAKA POWER DISTRIBUTION COMPANY LIMITED
(An Enterprise of the Government of the People's Republic of Bangladesh)
Website: www.dpdc.org.bd

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স্মারক নম্বর: ৮৭.৪০৪.৪০৮.০১.০৭.০১৯.২০১৫. ১৩৫৮

তারিখ: ০৫ কার্তিক, ১৪২৬ বঙ্গাব্দ
২১অক্টোবর, ২০১৯ খ্রিস্টাব্দ

সহযোগী প্রধান
ইলেক্ট্রিক্যাল এন্ড ইলেক্ট্রনিক ইঞ্জিনিয়ারিং ডিপার্টমেন্ট
ড্যাফোডিল ইন্টারন্যাশনাল ইউনিভার্সিটি

বিষয়: Electrical & Electronic Engineering Department-এর শিক্ষার্থীকে ঢাকা পাওয়ার ডিস্ট্রিবিউশন কোম্পানি লিমিটেড (ডিপিডিসি)'তে ইন্টার্নশিপ- এর অনুমতি প্রদান।

সূত্র: আপনার ২৩ সেপ্টেম্বর, ২০১৯ খ্রি. তারিখের পত্র।

উপর্যুক্ত বিষয় ও সূত্রের মাধ্যমে প্রেরিত পত্রের প্রেক্ষিতে সদয় অবগতির জন্য জানানো যাচ্ছে যে, নিম্নবর্ণিত ছকে উল্লিখিত আপনার বিশ্ববিদ্যালয়ের **Electrical & Electronic Engineering Department** এর ১১ জন শিক্ষার্থীকে সুপারিনটেন্ডিং ইঞ্জিনিয়ার, ট্যারিফ এন্ড এনার্জি অডিট, ডিপিডিসি- এর তত্ত্বাবধানে ০২ মাসের জন্য ইন্টার্নশিপ সম্পন্ন করার নিমিত্ত নিম্নবর্ণিত শর্ত সাপেক্ষে অনুমতি প্রদান করা হলো:

Sl. No.	Name of the Student	Student ID	Remarks
1	2	3	4
1.	Mr. Abu Sufian	141-33-1748	
2	Mr. Md Maruf Ahmed	163-33-3601	
3	Mr. Abdur Rouf	163-33-3605	
4	Mr. Imran Hossen	163-33-3633	
5	Mr. Md. Zahid Hasan	163-33-3658	
6	Mr. Md Yasin Arafat	163-33-3659	
7	Mr. Md Zakaria Shagor	163-33-3672	
8	Mr. Yeasin Chowdhury	163-33-3697	
9	Mr. Md Imranul Hoq Chowdhury	163-33-3698	
10	Mr. Md Nuralam	163-33-3699	
11	Mr. Md Sajjad Hossan Rony	163-33-3632	

শর্তাবলী:

ক. ডিপিডিসি- তে ইন্টার্নশিপ সম্পন্ন করার জন্য কোন রকম ভাতা প্রদান করা হবে না;
খ. উক্ত ইন্টার্নশিপ সম্পন্ন করার সকল ব্যয়ভার সংশ্লিষ্ট শিক্ষার্থী কর্তৃক বহন করতে হবে অর্থাৎ এতে ডিপিডিসি'র কোন রকম আর্থিক সংশ্লিষ্টতা থাকবে না;
গ. ডিপিডিসি সংক্রান্ত যে কোন তথ্য শিক্ষা কার্যক্রম ব্যতীত অন্য কোন ক্ষেত্রে ব্যবহার করা যাবে না;
ঘ. ইন্টার্নশিপ চলাকালীন ডিপিডিসিতে অবস্থানকালে শিক্ষার্থী-কে বিদ্যুৎ স্থাপনার অভ্যন্তরে ব্যক্তিগত নিরাপত্তার বিষয়ে সচেষ্ট ও সচেতন থাকতে হবে;
ঙ. ডিপিডিসি'র সংরক্ষিত/ কেপিআই/ গুরুত্বপূর্ণ এলাকার নিরাপত্তা বিঘ্নিত হয় এমন কোন কাজ করা যাবে না।

কর্তৃপক্ষের অনুমোদনক্রমে,

মোহা: মনিরুজ্জামান
ডিজিএম, এমপ্লয়ি ম্যানেজমেন্ট (আডমিনিসট্রেইশন)
হিউম্যান রিসোর্সেস, ডিপিডিসি।

বিতরণ:
০১. এক্সিকিউটিভ ডিরেক্টর (আডমিনিসট্রেইশন এন্ড এইচ.আর/ ইঞ্জিনিয়ারিং/ অপারেশনস/ ফিন্যান্স), ডিপিডিসি।
০২. জেনারেল ম্যানেজার (এইচ.আর/ আইসিটি এনার্জি এন্ড মিটারিং)/ কোম্পানি সচিব, ডিপিডিসি।
০৩. সিসিও টু ম্যানেজিং ডিরেক্টর/ সুপারিনটেন্ডিং ইঞ্জিনিয়ার, ট্যারিফ এন্ড এনার্জি অডিট, ডিপিডিসি।
০৪. জনাব....., ডিপিডিসি।
০৫. অফিস কপি/ মাস্টার ফাইল।

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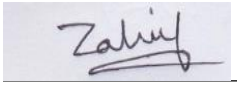
Certification

This is to certify that this internship entitled **"Study on Tariff and Energy Audit of DPDC"** is done by the following students under my direct supervision and this work has been carried out by the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on December - 2019.

Signature of the candidates



Md. Zahid Hasan
163-33-3658

Md. Yasin Arafat
161-33-3659

Countersigned

K.B.M Rakib Hasan

Lecturer

Department of Electrical and Electronic Engineering Faculty of Engineering

Daffodil International University

DECLARATION

The internship entitled **"Study on Tariff and Energy Audit of DPDC"** submitted by Name: **Md. Zahid Hasan**, Id No: **163-33-3658** and Name: **Md. Yasin Arafat** Id No: **163-33-3659**, Session: Fall-2019 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering on 2019.

BOARD OF EXAMINERS

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Department of EEE, DIU

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Dr. Internal Member
Professor
Department of EEE, DIU

Dedicated to

Our Parents

And

Teachers

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LIST OF ABBREVIATIONS

SCADA	Supervisory Control & Data Acquisition
DASMS	Digitalization and Automation of Substation Metering System
SAS	Sub-station Automation System
RTU	Remote Terminal Unit
IP	Internet Protocol
MDM	Meter Data Management
DCS	Distributed Control System
CB	Circuit Breaker
CT	Current Transformer
PT	Potential Transformer
DC	Direct Current
DESA	Dhaka Electric Supply Authority
DPDC	Dhaka power distribution Company LTD.
BPDB	Bangladesh Power Development Board
KV	Kilo Volt
KVA	Kilo Volt Ampere
LV	Low Voltage
MV	Medium Voltage
MCB	Miniature Circuit Breaker
PFI	Power Factor Improvement
REB	Rural Electrification Board
PGCB	Power Grid Company of Bangladesh
WZPDC	West Zone Power Distribution Company Ltd
REB	Rural Electrification Board
IPP	Independent Power Producer
IEEE	Institute of Electrical and Electronics Engineer
BERC	Bangladesh Energy Regulating Commission
LTV	Low Tension Voltage
MTV	Medium Tension Voltage
EHV	Extra High tension Voltage
AIS	Air Insulated Sub-station
GIS	Gas Insulated Sub-Station
PLCC	Power Line Carrier Communication
GSM	Global System for Mobile Communication
CPU	Central Processing Unit
MTU	Maximum Transmission Unit

ACKNOWLEDGEMENTS

First we express our heartiest thanks and gratefulness to almighty Allah for his Divine blessing makes us possible to complete this field study successfully. We feel grateful to and wish our profound our indebtedness to **Professor Dr. Shamsul Alam, Professor & Dean, Faculty of Engineering,** Daffodil International University, Dhaka. Deep knowledge & keen interest of our supervisor in the field of Electric power influenced us to carry out this thesis paper. His endless patience, scholarly guidance, continual encouragement, energetic supervision, constructive criticism, valuable advice at all stage made it possible to complete this paper. Next, we are grateful to **A.N.M Nazmul Haque (Executive Engineer), Abu Rayhan (Assistant Engineer)**, **Md. Mosiur Rahman (Sub-assistant Engineer),** of DPDC for his vast support for this internship. We would like to thank my entire course mate in Daffodil International University, who took part in this discuss while completing the course work.We also want to convey our thankfulness to my Field study co-supervisor **K.B.M Rakib Hasan (Lecturer**) **Department of EEE,** for his help, support and constant encouragement.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

We got an opportunity to complete our field study at Dhaka Power Distribution Company Ltd. Our internship started on 24 October, 2019 and ended on 24th December, 2019. We got knowledge about Tariff & Energy Audit System, Metering System of DPDC. Also got knowledge about DPDC two pilot project SCADA (Supervisory Control & Data Acquisition) & Digitalization and Automation of Metering System (DASMS). This study is on tariff structure would consist of two parts. In the solicited bids, the bidders shall offer bulk power tariff based on the capacity payment and energy payment and also provide the equivalent tariff. The capacity payment will be made in Bangladeshi currency (Taka), but denominated in both Dollars and local currency. This will cover debt service, return on equity, fixed operation and maintenance cost, insurance and other fixed cost. The energy payment will be denominated in local currency to the extent to which the variable costs are in local currency. The aim of the Supervisory Control & Data Acquisition project (SCADA) is Control industrial procedures locally or at remote areas & Monitor, accumulate, and process real time information and also Digitalization and Automation of Metering System (DASMS) is used Monthly bills of PDB and PGCB can be accurately deducted, SMS Alert for VIP feeders, server based data archive, energy balance of all sub-stations can be completed quickly and accurately.

CHAPTER 1
INTRODUCTION

1.1 Structure of power sector

Power division is responsible for formulating policy relating to power and supervise, control and monitor the developmental activities in the power sector of the country. To implements its mandate the power division is supported by a number of organizations, related with generation, transmission and distribution. The organizational linkage is as follows:

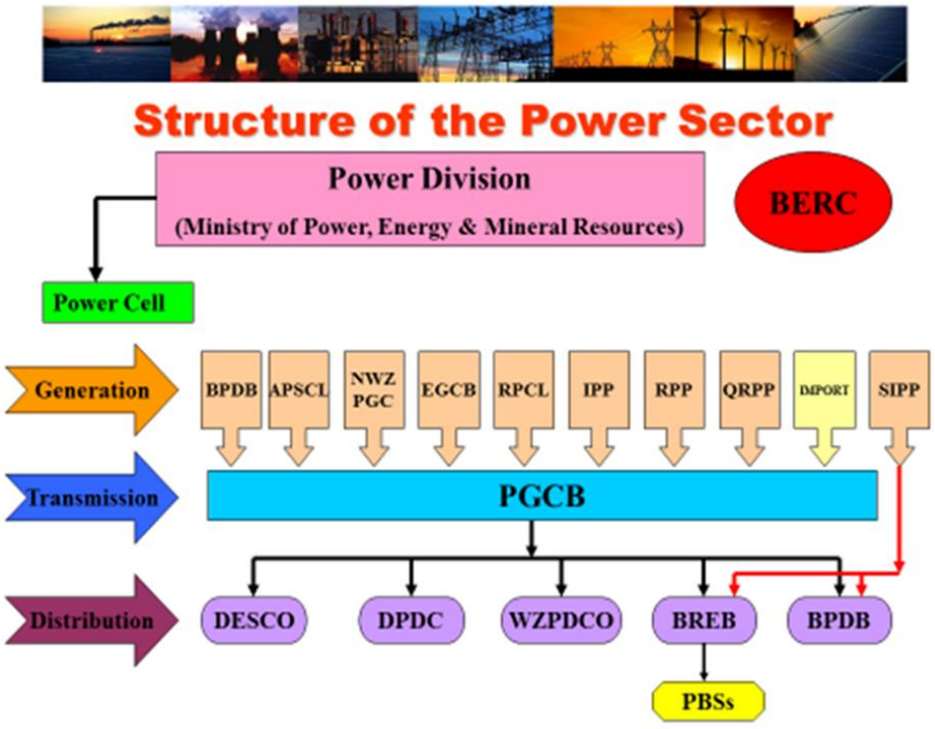

Fig 1.1: Structure of the Power sector

1.2 Apex institution

- Power division, ministry of power, energy & mineral resources(MPEMR)

1.3 Regulator

- Bangladesh Energy Regulatory commission(BERC)

1.4 Generation

- Bangladesh Power Development Board(BPDB)
- Ashuganj Power Station Company Limited(APSCL)
- Electricity Generation Company of Bangladesh(EGCB)
- North West Power Generation Company Limited(NWPGCL)
- Independent Power Producers(IPPS)

1.5 Transmission

- Power Grid Company of Bangladesh Limited(PGCB)

1.6 Distribution

- Bangladesh Power Development Board(BPDB)
- Dhaka Power Distribution Company Limited(DPDC)
- Dhaka Electric Supply Company Limited(DESCO)
- West Zone Power Distribution Company(WZPDC)
- Rural Electrification Board(REB)

1.7 Broad Objective

The Broad Objective of this research are mainly to understand of this each and every equipment of distribution substation & Tariff and Energy Audit of DPDC.

1.8 Dhaka Power Distribution Company Limited (DPDC)

DPDC is one of the largest power distribution companies in Bangladesh. Dhaka Power Distribution Company Limited (DPDC) had been incorporated on 25th October, 2005 under the Companies Act 1994

with an authorized share capital of Tk. 10,000 (ten thousand) crore divided into 100 (one hundred) crore ordinary share of Tk. 100 each. The company was granted permission to commence business from 25th October, 2005 and started its function from 14th May 2007. Company started its commercial operation on 1st July of 2008 by taking over all assets and liabilities from the then DESA .While the company started its operation the number of customers were 6,55,908, now we have around 12,53,486 (on February, 2019)

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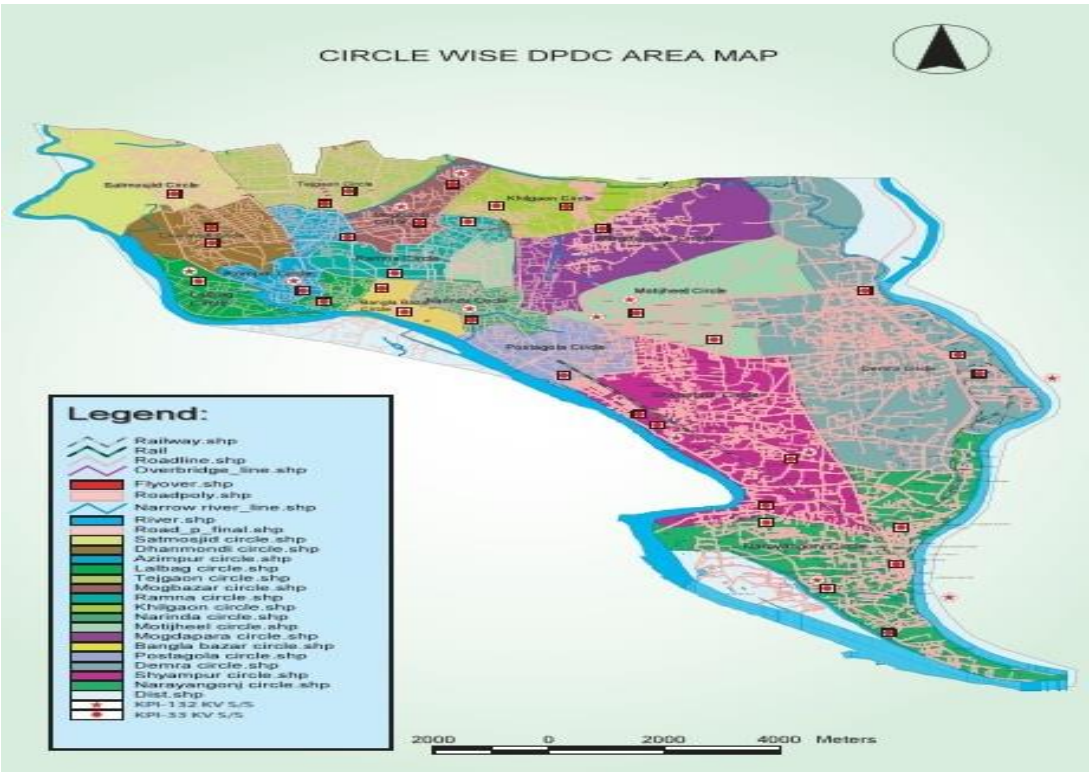


Fig 1.2: DPDC area map

1.9 VISION of DPDC

Provide quality and reliable electricity to the people of Dhaka city and Narayangonj area for desired economy, social and human development of the country.

1.10 MISSION of DPDC

- To deliver quality electricity with service excellence.
- To make electricity available on demand within the geographical area of DPDC.
- To ensure customer's satisfaction.

- To develop new mindset for all of the employees congruent with corporate culture.
- To reach self-sufficiency and profitability by increasing income and reducing expenditure.

1.11 COMMITMENT

- Quality power supply to all customers'.
- Quickest response to customers' need.
- Initiatives to match the changing needs of the customers.
- Digitalization of Distribution System.

1.12 CORE OBJECTIVES:

- **For the customers:** Rendering reliable and uninterrupted power supply with customers care.
- **For the owner and shareholders:** Financial sustainability of the Company.
- **For the society:** Strengthening the social values and undertake corporate social responsibility.
- **For the nation:** Taking all about effort to achieve national growth and economic prosperity.

1.13 Methodology

The work of this paper has been carried out with the help of different sources. In planning, the paper was cheeked by the approved men of the SCADA Bhaban, DPDC. The data was collected correctly throughout the session. While there have been several sources, some of them are mentioned here as references. Data from the study has been obtained from the following sources:

- Tariff and Energy Audit Department
- General Service Department.
- Engineering Department.

1.14 Future plans of DPDC

- Introduction of smart grid system.
- Construction of 21 new 132/33 KV sub-stations and 41 new 33/11 KV sub-stations.
- 1493 km Construction of new distribution line 1462 km distribution line renewal and 361 km distribution. Installation of 11 kV and 165km 33 kV underground cable
- 653 km 132 kV and 700 km Installation of 33 kV underground new cable.
- Upgrading the Power Factor with 850 MVR Reactive Power Compensation at 132 KV and 33 KV Voltage Levels.

CHAPTER 2

TARIFF

2.1 Introduction

The electrical energy created by a power plant is conveyed to huge Customers. The Customers can be convinced to utilize electrical energy on the off chance that it is sold at sensible rates. The tariff rate at which electrical energy is sold normally becomes consideration welcoming for electric stock organization. The stock organization needs to guarantee that the tax is with the end goal that it not just recoups the all out expense of delivering electrical energy yet additionally gains benefit on the capital venture. In any case, the benefit must be minor especially for a nation like Bangladesh where electric inventory organizations go under Government sector and are constantly dependent upon criticism.

The rate at which electricity is supplied to customer is called Tariff.

2.2 Objective of Tariff

1. Saving of cost of generating electrical energy at the power plant.
2. Saving cost on the assets investment in transmission and distribution sector.
3. Recovery of cost of activity and maintenance of supply of electrical energy e.g., metering apparatus, charging and billing.
4. An appropriate benefit on the capital venture.

2.3 Considerations for the proposed tariff

(i) The 2018-19 fiscal year is considered a test year and the fiscal year 2019-20 is also considered in the project.

(ii) The 2019-20 financial year is meaningful considering that the interest rate on real loans will remain unchanged. And interest rate forecasts for the 2020 calendar year loan.

(iii) With the increase of current DPDC, the development of new infrastructure, transmission and distribution lines, construction of new substations and old sub-station capacity have been

increased. Besides, monetary policy! The bronze finish was increased. Therefore, the expenditure on the maintenance sector in the financial year 2019-20 is 2018-19.

(iv) Other operating incomes are projected to increase somewhat in the fiscal year and 2020. Financing charges are increasing steadily as loan volumes from the government and the government increase.

(v) Financing charges are increasing steadily as loan volumes from the government and the government increase**.**

2.4 The rationale for the tariff adjustment proposal

(i) With the increase in the number of customers of DPDC, to maintain the quality of customer service and increase the honest status of the officers / employees in the implementation of the ongoing project and the construction of new sub-centers, the time spent on retail pricing to meet the additional operating costs.

(ii) Distribution Line keeping commodities up, the cost of maintenance in the maintenance sector is increasing due to inflation. Etc. It is advisable to adjust the retail price considerations.

(iii) At the present time, the non-interest-bearing revenues taken against all loan projects will be charged in the revenue sector, so it is reasonable to adjust the price as the cost in this sector increases slightly.

(iv) DPDC is moving towards using more advanced technology for quality power supply at the moment. With the acquisition of technology, expenditure in this sector is increasing. Therefore, it is logical to adjust the retail price to cover the cost.

2.5 Desirable Characteristics of a Tariff

A tariff should have the following desirable characteristics:

2.5.1 Proper return

The tariff should be with the end goal that it guarantees the best possible come back from every customer. At the end of the day, the complete receipts from the customers must be equivalent to the expense of generating and providing electrical energy in addition to reasonable benefit.

2.5.2 Fairness

The tariff must be reasonable so various types of customers are happy with the rate of charge of electrical energy. In this way a large customer should be charged at a lower rate than a little customer. It is on the

grounds that expanded energy utilization spreads the fixed charges over a large number of units, along these lines decreasing the general expense of delivering electrical energy.

2.5.3 Simplicity

The tariff ought to be basic with the goal that a conventional customer can simply get it.

2.5.4 Reasonable profit

The benefit component in the tariff should be sensible. An electric stock organization is an open service organization and for the most part appreciates the advantages of imposing business model.

2.5.5 Attractive

The tariff ought to be attractive with the goal that huge number of customers are inspired to utilize electrical energy. Efforts ought to be made to fix the tariff in this way that customers can pay effectively.

2.6 Types of Tariff

There are five types of tariff, described below:

2.6.1 Simple tariff

When there is a fixed rate per unit of energy consumed, it is known as simple tariff.

Simple Tariff $= e \times z$, Where e = energy & z = Unit Price

2.6.2 Flat rate tariff

When various kinds of customers are charged at various uniform per unit rates, it is known as flat rate tariff.

2.6.3 Block rate tariff

At the point when a given block of energy is charged at a identified rate and the succeeding blocks of energy are charged at logically reduced rates, it is known as a block rate tariff.

2.6.4 Two part tariff

At the point when the rate of electrical energy is charged based on most extreme demand of the customer and the units consumed, it is known as two-part tariff.

2.6.5 Power factor tariff

It is the tariff in which Power factor of customer's load taken into consideration is called power factor tariff.

2.7 Tariff Rate

2.7.1 Low Voltage (LT) 230/400 Volt

Electricity Supply: Low Voltage AC Single Phase 230 Volt and Three Phase 400 Volt

Frequency: 50 cycle/second

Approved Demand: Single Phase 0-7.5 KW and Three Phase 0-50 KW

2.7.2 Medium Voltage (MT):11 KV

Electricity Supply: Medium Voltage AC 11 KV

Frequency: 50 cycle/second

Approved Demand: 50KW to maximum 5MW

2.7.3 High Voltage (HT):33 KV

Electricity Supply: High Voltage AC 33 KV

Approved Demand: 5MW to maximum 30MW (Must be Double circuit for above 20MW)

2.7.4 Extra High Voltage (EHT): 132 KV and 230 KV

Electricity Supply: Extra High Voltage AC 132 KV and 230 KV

Approved Demand: EHT-1: 20MW to maximum 140 MW (Single or double circuits in technical consideration); EHT-2: Above than 140 MW.

2.8 Tariff Retail Rate for 2019-2020

Consumer Category		Existing Tariff as(01-12-2017)		**Proposed Tariff RATE**	PROPOSED RETAIL TARIFF			
SL No	Domestic	KWH	Current RATE PER UNIT		Yearly Sold kwh (2019-2020)	% of sold unit	Current tariff Yearly (Taka) (2018-2019)	**Proposed Tariff Yearly (Taka) (2019-2020))**
	a	b	c	**d**	**g**	h	i=c*f	**j=g*d**

230/400 Volt; Low Voltage (LT) LT- A = Residential	Life Line: 0-50	3.50	**3.50**	10121193	0.11	35424176	**35424176**
	1st Slab (0-75)	4.00	**4.00**	863123715	9.23	3452494862	**3452494862**
	2nd Slab (76-200)	5.45	**5.45**	1163615430	12.44	6341704094	**6341704094**
	3rd Slab (201-300)	5.70	**5.70**	568361477	6.08	3239660418	**3239660418**
	4th Slab (301-400)	6.02	**6.02**	379692350	4.06	2285747946	**2285747946**
	5th Slab (401-600)	9.30	**9.30**	388961635	4.16	3617343204	**3617343204**
	6th Slab (600 above)	10.70	**10.70**	410665406	4.39	4394119839	**4394119839**
Total A Tariff =>				3784541206	40.47	23366494539	**23366494539**
LT- B = Irrigation		**4.00**	**4.00**	**120145**	0.00	480579	**480579**
Total B Tariff				120145	0.00	480579	**480579**
LT-C1 = Small Industrial				**0**	0.00		
	Flat Rate	8.20	**8.20**	**258492489**	2.76	2119638412	**2119638412**
	Off Peak	7.38	**7.38**	**294374831**	3.15	2172486254	**2172486254**
	Peak	9.84	**9.84**	**102582484**	1.10	1009411645	**1009411645**
Total C1 Tariff				655449805	7.01	5301536311	**5301536311**
LT-C2= Construction,		**12.00**	**12.00**	**55469818**	0.59	665637816	**665637816**

D1	LT-D1 = Education, Relegious & Charitable Organization and Hospital		5.73	**5.73**	**93249277**	1.00	534318358	**534318358**
	Total D1 Tariff				**93249277**	1.00	534318358	534318358
D2	LT-D2 =Street Light & Water Pump& Battary Charging Station		7.7	**7.70**	**32300948**	0.35	248717299	**248717299**
	Total D2 Tariff				**32300948**	0.35	248717299	248717299
E	LT- E = Commercial & Office	Flat Rate	10.3	**10.30**	**448428614**	4.80	4618814726	**4618814726**
		Off Peak	9.27	**9.27**	**152233257**	1.63	1411202295	**1411202295**
		Peak	12.36	**12.36**	**63012582**	0.67	778835511	**778835511**
	Total E Tariff				663674453	7.10	6808852532	**6808852532**
T	LT-T= Temporary		16	**16.00**	**246812**	0.00	3948996	**3948996**
	Total T Tariff				**246812**	0.00	3948996	3948996

T	LT-T= Temporary		16	**16.00**	**246812**	0.00	3948996	**3948996**
	Total T Tariff				**246812**	0.00	3948996	3948996
MT-1	11 kV; Medium voltage (MT):					0.00		
	MT-1= Residential	Flat Rate	8.0	**8.00**	**126392621**	1.35	1011140971	**1011140971**
		Off Peak	7.2	**7.20**	**22076166**	0.24	158948397	**158948397**
		Peak	10.0	**10.00**	**8704247**	0.09	87042470	**87042470**
	Total MT-1 Tariff				157173035	1.68	1257131838	**1257131838**
MT-2	**MT-2= Commercial & Office,**					0.00		
		Flat Rate	8.4	**8.40**	**86682637**	0.93	728134155	**728134155**
		Off Peak	7.6	**7.56**	**688581826**	7.36	5205678608	**5205678608**
		Peak	10.5	**10.50**	**236259188**	2.53	2480721472	**2480721472**
	Total MT-2 Tariff				1011523652	10.82	7686400080	7686400080
MT-3	**MT-3= Industrial**					0.00		
		Flat Rate	8.15	**8.15**	**15202230**	0.16	123898171	**123898171**
		Off Peak	7.34	**7.34**	**1166741058**	12.48	8563879363	**8563879363**
		Peak	10.19	**10.19**	**276908320**	2.96	2821695783	**2821695783**
	Total MT-3 Tariff				1458851607	15.60	11509473317	**11509473317**
MT-4	**MT-4= Construction,**					0.00		
		Flat Rate	11	**11.00**	**7648**	0.00	84128	**84128**
		Off Peak	9.9	**9.90**	**1760906**	0.02	17432965	**17432965**
		Peak	13.75	**13.75**	**695731**	0.01	9566298	**9566298**
	Total MT-4 Tariff				2464284	0.03	27083391	**27083391**

MT-5	**MT-5=General purpose**					0.00		
		Flat Rate	8.05	**8.05**	**121787120**	1.30	980386314	**980386314**
		Off Peak	7.25	**7.25**	**198738225**	2.13	1440852129	**1440852129**
		Peak	10.06	**10.06**	**71272296**	0.76	716999295	**716999295**
	Total MT-5 Tariff				391797640	4.19	3138237738	**3138237738**
MT-6	MT-6=Temporary		15	**15.00**	**1511467**	0.02	22672001	**22672001**
	Total MT-4 Tariff				**1511467**	0.02	22672001	22672001
HT-1	**33 kV; High voltage (HT):**					0.00		
	HT-1 = General purpose	Flat Rate	8	**8.00**	**27292337**	0.29	218338692	**218338692**
		Off Peak	7.2	**7.20**	**0**	0.00	0	**0**
		Peak	10	**10.00**	**0**	0.00	0	**0**
	Total HT-1 Tariff				27292337	0.29	218338692	**218338692**
HT-2	**HT-2 = Commercial & Office,**					0.00		
		Flat Rate	8.3	**8.30**	**0**	0.00	0	**0**
		Off Peak	7.47	**7.47**	**19428552**	0.21	145131283	**145131283**
		Peak	10.38	**10.38**	**10615176**	0.11	110185527	**110185527**
	Total HT-2 Tariff				30043728	0.32	255316810	**255316810**
HT-3	**HT-3 = Industries**					0.00		
		Flat Rate	8.05	**8.05**	**101527268**	1.09	817294504	**817294504**
		Off Peak	7.25	**7.25**	**592051358**	6.33	4292372344	**4292372344**
		Peak	10.06	**10.06**	**182557797**	1.95	1836531436	**1836531436**
	Total HT-3 Tariff				876136422	9.37	6946198284	**6946198284**

HT-4	**HT-4 = Construction**					**0.00**		
		Flat Rate	**10.00**	**10.00**	**0**	**0.00**	**0**	**0**
		Off Peak	**9.00**	**9.00**	**0**	**0.00**	**0**	**0**
		Peak	**12.50**	**12.50**	**0**	**0.00**	**0**	**0**
	Total HT-4 Tariff				**0**	**0.00**	**0**	**0**
EHT-1	**132 KV; Extra High voltage (EHT):**					**0.00**		
	EHT-1=General purpose (20 MW upto 140 MW),	**Flat Rate**	**7.95**	**7.95**	**0**	**0.00**	**0**	**0**
		Off Peak	**7.16**	**7.16**	**83285888**	**0.89**	**596326961**	**596326961**
		Peak	**9.94**	**9.94**	**26066898**	**0.28**	**259104966**	**259104966**
	Total E HT-1 Tariff				**109352786**	**1.17**	**855431927**	**855431927**
EHT-2	**EHT-2=General purpose (140 MW upto)**	**Flat Rate**	**7.9**	**7.90**	**0**	**0.00**	**0**	**0**
		Off Peak	**7.11**	**7.11**	**0**	**0.00**	**0**	**0**
		Peak	**9.88**	**9.88**	**0**	**0.00**	**0**	**0**
	Total EHT-2 Tariff				**0**	**0.00**	**0**	**0**
1	**Total Energy /Taka Only =>**				**9351199422**	**100.00**	**69777337587**	**69777337587**
2	**Average Sold Unit Charge (Energy Only) =>**						**7.4619**	**7.4619**
3	**Demand Charge+PFC charge=>**						**2736802491**	**2736802491**
4	**Total (Energy Charge+Demand Charge+PFC)=>**						**72514140078**	**72514140078**
5	***Average Billing rate (Energy Charge +Demand Charge+PFC) =>***						***7.7545***	***7.7545***
6	**others Charge=>**						**1394929052**	**1394929052**
7	**TOTAL (Energy Charge+Demand Charge +others) =>**						**73909069130**	**73909069130**
8	**Total Average Billing rate (Energy Charge+Demand Charge +PFC+others) =>**						**7.9037**	**7.9037**

Table 2.1: Proposed Tariff Retail Rate for 2019-2020

Distribution Cost with System Loss Curve

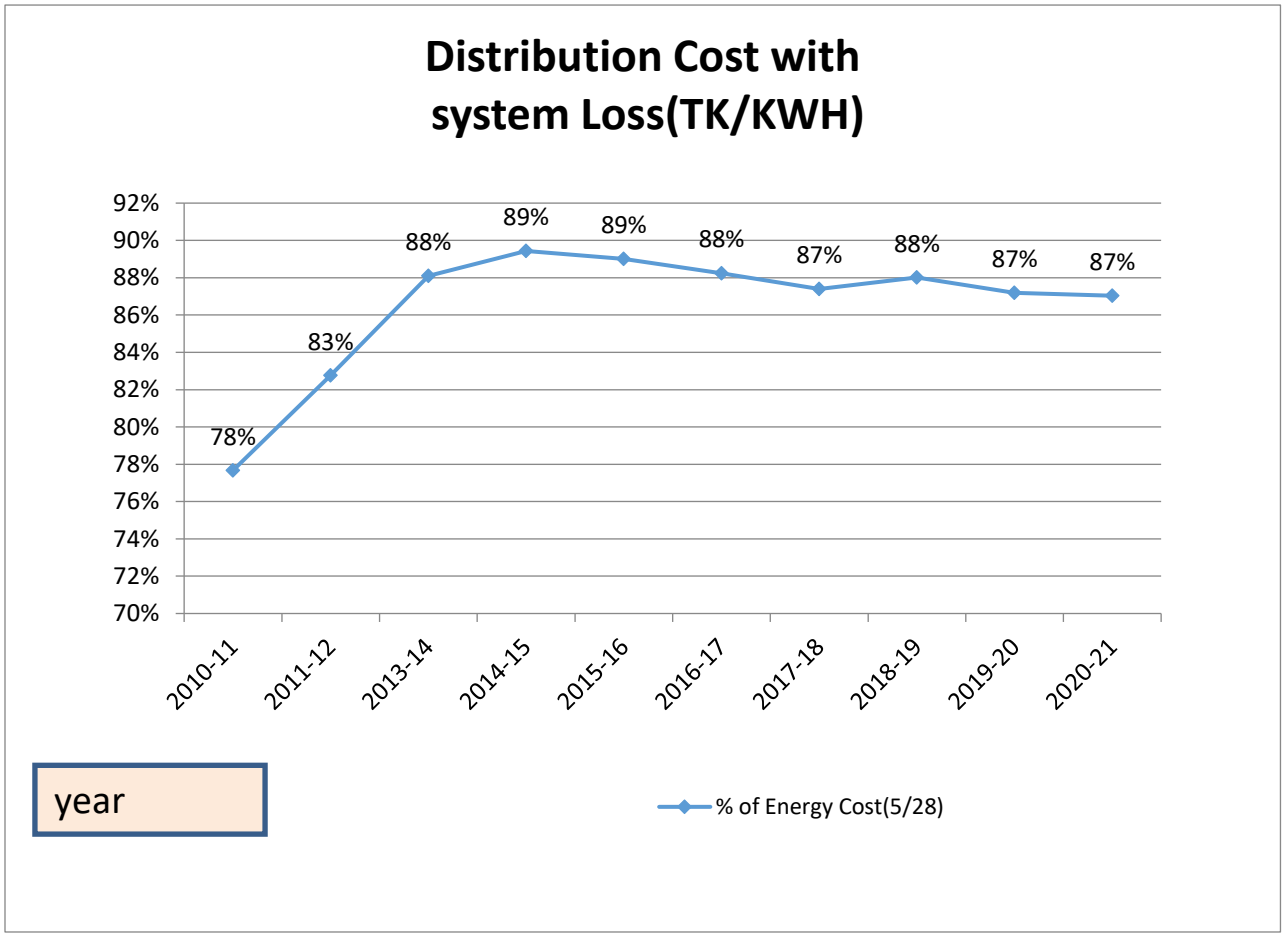


Table 2.2: Curve of distribution cost with system loss

Dhaka Power Distribution Company Limited

Retail Distribution Cost of Service

SL	Description	2015-16 (Audited)	2016-17 (Audited)	2017-18 (Audited)	2018-19 (Provisional)	2019-20 (Present tariff)	2020-21 (Present tariff)
1	Energy Import from PDB (MkWh)	8047.001	8424.043	8818.954	9404	10063	10868
2	Purchased Power Cost (MTk)	45371.97	48043	51196	55346	59220	63957
3	Wheeling Charge (MTK)	1976.32	2171	2289	2501	2789	3012
4	PFC +SOLAR ENERGY	108.678	152	489	601	647	700
5	Total Purchased Power Cost (MTK)	47456.96	50365.07	53972.99	58448.36	62655.83	67669.13
6	Purchased Power Cost - Without System Loss(TK/KWH) (5/1)	5.8975	5.9787	6.1201	6.2150	6.2265	6.2266
7	Energy Sales (MKWH)	7308	7716	8165	8719	9338	10091
8	System Loss (%)	9.18%	8.40%	7.41%	7.29%	7.20%	7.15%
9	Sale of Electricity-Energy,Demand+PFC and Service Charge (MTK)	51890.92	55176.62	60846.14	66847.93	72514.14	77812.95
10	Average Billing Rate (TK/KWH)(9/7)	7.10	7.1508	7.45	7.667	7.765	7.711
11	Other Operating Revenue (MTK)	1074.619	1016.1	1176	1329	1395	1465
12	Non Operating Income (MTK)	1348.501	1209.7	434.5	916.3	500.0	550.0
13	Total Revenue (MTK)(9+11+12)	54314.04	57402.35	62457.10	69092.78	74409.07	79827.62
14	Total Revenue (TK/KWH)(13/7)	7.43	7.44	7.649	7.924	7.968	7.911

Table 2.3: Retail Distribution Cost of Service

CHAPTER 3
ENERGY AUDIT

3.1 Introduction

An energy audit is an inspection survey and an analysis of energy streams for energy preservation in a structure. It may include a procedure or system to decrease the amount of energy contribution to the system without negatively influencing the output.

3.2 Importance of energy audit

An energy audit is typically a procedure of analysis of a flexibility that can help decrease the energy utilization of a residential or commercial site and save energy expenses to a huge extent. These types of energy audits assist to determine the energy-saving deficiencies in homes and business spaces, which thus assists with countering those issues, successfully. At present times, there are many energy preservation organizations, which provide highly suitable services to the consumer for decreasing the energy consumption of the living spaces and control energy expenses. These organizations use advanced audit strategies to reduce the utilization of energy and save expenses.

3.3 Benefits of energy audit

- It helps decrease energy expenses in your facility.
- This helps reduce the reliance on outside energy sources.
- It decreases natural harm and contamination
- It can rise the protection of your energy supply.
- It can decrease the utilization of natural resources.
- It helps us to increase the life span of the accessories in your facility.

3.4 Energy audit process

An energy audit is a four-step procedure that includes the periods of planning, investigating, implementing, and sustaining. Exhaustive planning and cautious increase the chances of a fruitful energy audit with a greatest return on investment.

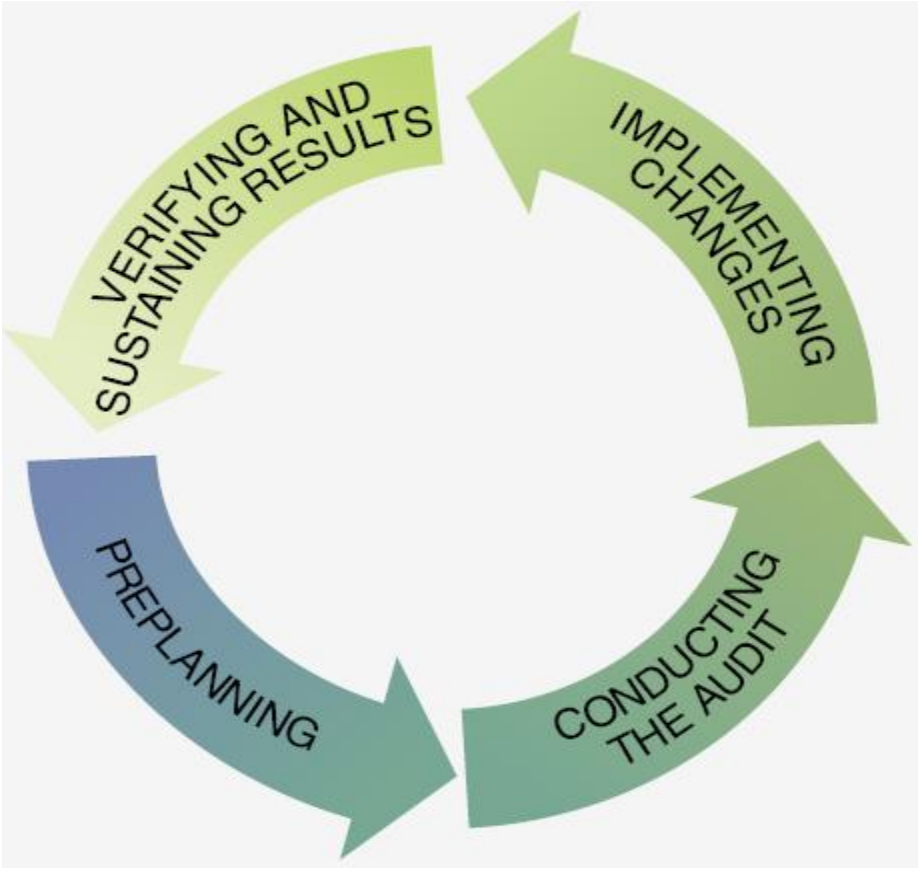


Fig 3.1: Energy audit process

3.5 Substations list of DPDC

NORTH
Name of S/S
Asad Gate 33/11 KV S/S
Azimpur 33/11 KV,
Banasree 33/11 SS
Banshal 33/11KV S/S
BSMMU 33/11KV S/S
Dhanmondi 132/33/11KV S/S
Dhanmondi 33/11KV S/S
DMC
Goran 33/11KV S/S
Green Road 33/11KV S/S
Green Road Dormatory 33/11 SS
Japan Garden 33/11 KV,
Jigatola 33/11KV S/S
Kakrail 33/11KV S/S
Kallyanpur & Agargaon 33/11KV S/S
Kamrangirchar 132/33/11KV S/S
Kamrangirchar 33/11KV S/S
Kawranbazar 33/11KV S/S
Khillgaon 33/11KV S/S
LALBAGH 132/33 KV S/S
LALBAGH 33/11 KV S/S
Lalbagh 33/11KV S/S
Lalmatia 33/11KV S/S
Moghbazar 132/33/11KV S/S
Moghbazar 33/11KV S/S
Mugdhapara Hospital
New Ramna 33/11KV S/S
Satmasjid 33/11KV S/S
Shatmasjid 132/33 KV S/S
Shere Bangla Nagar 33/11 KV S/S
T&T 33/11 KV,
Taltola 33/11KV S/S
Tejgoan 33/11KV S/S
Ullon 132/33/11KV S/S

Table 3.1: Substations list of DPDC (NORTH)

SOUTH
Name of S/S
Bangabhaban 132/11KV S/S
Biddyut Bhaban 33/11 KV
Char Syedpur 33/11KV S/S
Dapa 33/11 kV
Demra 33/11KV S/S
Fatullah 33/11KV S/S
IG Gate GIS 33/11 kV
Kazla 33/11KV S/S
Khanpur 33/11KV S/S
Kumertuly 33/11KV S/S
Laxmi Narayan Cotton Mill 33/11 kV
Madarteck 132/33KV S/S
Madarteck 33/11KV S/S
Maniknagar 132/33/11KV S/S
Maniknagar 33/11KV S/S
Matuail 132/33 KV S/S
Matuail 33/11KV S/S
Mitford 33/11 kV
Mondalpara 33/11KV S/S
Motijheel 33/11 kV
Nandalalpur 33/11 kV
Narayangonj (west) BSCIC33/11KV S/S
Narinda 132/33KV S/S
Narinda 33/11KV S/S
Postogola 33/11KV S/S
Sarulia 33/11KV S/S
Shyampur 132/33KV S/S
Shyampur 33/11KV S/S
Shyampur BISIC 33/11KV S/S
Siddhirganj 33/11KV S/S
Siddhirganj 132/33/11KV S/S
Sitalakhya 132/33KV S/S
Sitalakhya 33/11KV S/S

Table 3.2: Substations list of DPDC (SOUTH)

3.5.1 Dhanmondi 33/11 KV 2x 20/28 MVA Substation. (North)

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
	Dhanmondi (33 KV Side)							
1	33/11 KV Transformer No.1.	6604456	1	L&T	820.74	820.74	33.57	240000
2	33/11 KV Transformer No.2.	6604432	1	L&T	875.81	875.81	35.16	240000
	Dhanmondi (11 kV Side)							Total
A	Incomer from Transformer-1.	DHK-60976	1.0		95831.30	140524.10	44692.80	180
1	11 KV Azimpur U/G-.2.	DHK-61109	1.0		0.0	0.0	0.00	60
2	11 KV Museum U/G	DHK-61107	1.0		291718.6	308147.2	16428.60	60
3	11 KV BIRDEM U/G	DHK-61108	1.0		174017.1	188367.3	14350.20	60
4	11 KV New Elephant O/H	DHK-60981	1.0		472658.6	488754.3	16095.70	60
5	11 KV DPH U/G-.1	DHK-60978	1.0		189182.7	206219.8	17037.10	60
B	Incomer from Transformer-2.	8838009	1.0	GEC	191711.9	238542.9	46831.00	180
1	11 kV TSC Feeder	DHK60873	1.0		677120.5	677120.5	0.00	60
2	11 kV University O/H Feeder	DHK60882	1.0		963954.3	971374.0	7419.70	60
3	11 kV Azimpur-1 Feeder	DHK60872	1.0		885671.6	885671.6	0.00	60
4	11 kV P G Hospital Feeder	DHK60889	1.0		116751.2	135066.5	18315.30	60
5	11KV Dhanmondi O/H Feeder	DHK61110	1.0		533241.4	556754.7	23513.30	60
6	11 kV Surjasen Hall Feeder	DHK60880	1.0		355479.6	358753.4	3273.80	60
7	11 KV DPH-2	DHK60871	1.0		330240.4	393464.4	63224.0	60
8	11KV sonargaon feeder	DHK61115	1.0		287615.9	316656.1	29040.20	60
9	11kV Scada		1.0		17833.00	18258.50	425.50	60
10	11KV Balaka Feeder		1.0		74089395.00	74921450.00	832055.00	1

11	11KV Shanta property		1.0		210523.60	214111.90	3588.30	60
12	11KV Abdul Mone Ltd.		1.0		441.80	448.54	6.74	60000
13	Panthopath O/H		1.0		21173883.00	22259862.00	1085979.00	1
13	11KV Mogbazar		1.0		42176572.00	43574075.00	1397503.00	1

Table 3.3: Energy Balance Statement of Dhanmondi 33/11 KV sub-station.

3.5.2 Jigatola 33/11KV, 3 x 10/14 MVA Substation (north)

Sl		**Name of S/S. (Voltage level)**	**Meter**		METER	**Meter Reading**		**Diff.**	**OMF**
No.		**Name of Feeders.**	**Number**	**CF**	Make	**1/9/2019**	**1/9/2019**		
1		33 KV Jigatala CKT-1	30799088	1.0		4507.210	4552.360	45.15	240000
2		33 KV Jigatala CKT-2	30799135	1.0		1110.890	1126.700	15.81	240000
		Satmosjid 33/11 KV						**Total**	
3		33KV Satmosjid-Jigatola ckt	DHK61038	1.0		543.92	543.92	0.00	270000
		Jigatola (33 kV Side)						**Total**	
1		33 kV Kamrangirchar Ckt 2	8551181	1.0		27507.000	27507.000	0.00	1000
			DHK-00133	1.0		53434.400	53434.400	0.00	10000
2		33kv Kamrangirchar Ckt 1	8576919	1.0		20816.100	20816.100	0.00	1000
			77411760	1.0		4145.980	4145.980	0.00	180000
3		33 KV T-1	DHK61073	1.0		3067.640	3067.640	0.00	240000
4		33 KV T-2	DHK61075	1.0		3290.220	3290.220	0	240000
5		33 KV T-3		1.5		419216	419216	0	180
		Jigatola (11 kV Side)							
A		33/11 kV Transformer-1 Incoming	DHK61029	1.0		904.920	949.950	45.030	180000
1		11 kV Post office	DHK61074	1.0		2030.660	2067.840	37.18	60000
2		11 kV Lalmatia S/S. Feeder.	DHK60907	1.0		413.810	413.810	0.00	60000
3		11 kV Hazaribagh S/S -1 (Modina-Rayer Bazar)	DHK61032	1.0		752177.2	814427.5	62250.30	60
4		11 kV Hazaribagh S/S -2 FDR	DHK61034	1.0		196	196	0.00	60000
5		11 kV Hazaribagh Sw/s-2 (mitali)	DHK66479	1.0		1448974	1467593	18619.00	60

B	33/11 kV Transformer-2 Incoming	DHK610298	1.0		3762.810	3807.770	44.96	180000
6	11 kV Jigatola Local Feeder.	DHK61069	1.0		1931.860	1959.950	28.09	60000
7	11 kV Green Road Feeder via park.	61070	1.0		2441.72	2479.70	37.98	60000
8	11 kV Saleq Grand	8577014	1.0		2692.67	2733.49	40.82	60000
9	11 kV Hazaribagh O/H	DHK61033	1.0		2900.300	2924.670	24.37	60000
10	11 kV City College	DHK61031	1.0		1783.29	1810.46	27.17	60000
11	11 kV Road No. 2. Feeder.	DHK61035	1.0		2298.400	2335.610	37.21	60000
12	11KV Boubazar		1.0		2304.640	2337.340	32.70	60000
13	11 kV BGB Feeder.	DHK61030	1.0		871.670	871.670	0.00	60000
14	11kV Shimanto Square	DHK60946	1.0		598.140	612.550	14.41	60000
15	SS-2		1.0		2278.43	2322.27	43.84	60000
16	11 kV Meena Bazar Feeder.	DHK-60945	1.0		1011672.000	1024209.000	12537.00	60
17	AT-1	243284	1.0		72308.000	72308.000	0.00	10
18	AT-2	412277	1.0		26324.000	27030.000	706.00	10

Table 3.4: Energy Balance Statement of Jigatola 33/11 KV sub-station.

3.5.3 Kamrangirchar 33/11KV, 4 x 10/14 MVA Substation.

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
	Kamrangirchar (33 KV Side)							
1	33/11 KV Transformer No.1.	30799129	1.0		5201	5244	43.23	240000
2	33/11 KV Transformer No.2.	30799110	1.0		5120	5162	42.61	240000
3	33/11 kV Transformer T-33		1.0		2173	2219	46.36	240000
	Kamrangirchar (11 KV Side)						Total	
1	L11=Battola majar	6604427	1.0		6792	6824	32.00	40000
2	11 KV Beriband O/H	HA0211-01105-02	1.0		60812301	63979935	3167634.00	1
A	T31A (11 KV Incomer 1)		1.0		3691.32	3691.32	0.00	180000
3	11 KV Company Ghat O/H	30799521	1.0		2513.23	2513.23	0.00	60000
4	11 KV Panna Battery	DHK-15431	1.0		4488.17	4505.18	17.01	60000
5	11 KV Rasulpur O/H	HA0211-01042-02	1.0		32207120.00	33993025.00	1785905.00	1
B	Incomer from Transformer-32	6604433	1.0		5419.15	5475.81	56.66	180000
6	11 KV Kamrangirchar O/H	HA0211-01015-02	1.0		21484437	24663925	3179488.00	1
7	11 KV Eidgah	30799460	1.0		3884.57	3918.74	34.17	60000
8	11 kV Jhauchar	HA0210-01028-02	1.0		40022800	42377225	2354425	1
9	11 kV Koylaghat	HA0211-01259-02	1.5		23301840	25445105	2,143,265	1
10	11 KV RMU Express	HA0211-01248-02	1.0		79803556	80389372	585816	1
C	Transformer-33	DHK95817	1.0		2313621	2370720	57099.00	180
11	11 KV Muslim Bagh O/H	HA0211-00716-02	1.0		3872580	7074435	3201855.00	1
12	11 KV Ali Nagar O/H	HA0211-01022-02	1.0		72854859	75629515	2774656.00	1
13	11 KV (Nurbagh)	HA0211-00982-02	1.0		40046274	41714175	1667901.00	1
14	11KV Nayagaon	HA0211-01087-02	1.0		2112008	4787950	2675942	1
15	11KV Huzur Para		1.0		81644298	84246325	2602027	1
16	11KV Munsihati		1.0		6685333	7740665	1055332	1

Table 3.5: Energy Balance Statement Kamrangirchar 33/11KV sub-station.

3.5.4 Bangabhaban 132/11 KV, 2X28/35 MVA Substation. (South 2)

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders	Number	CF	Make	1/9/2019	1/9/2019		
	Maniknagar (132 kV Side)							
1	132 kV Bangabhaban Feeder-1.	06604332	1.00	L&T	1443.74	1453.46	9.72	720000
2	132 kV Bangabhaban Feeder-2.	06604430	1.00	L&T	1343.66	1353.51	9.85	720000
	Bangabhaban Converted to 33 KV)				.	.		
1	33 kV Bangabhaban Feeder-1.							
2	33 kV Bangabhaban Feeder-2.							
	Bangabhaban (11 kV Side)				Total 132 kv level=>	**Total 132 kv level=>**		
	-							
	-							
A	**Incomer from Transformer-1(GT-1).**	**4150744**	**1**	**IME**	1328303.30	1335350.30	**7047.00**	**1000**
1	11 kV Navana O/H Feeder	4150752	1.00	IME	204000.36	204870.91	870.55	1000
2	11 kV Motijheel-1Feeder	4150748	1.00	IME	18851.51	18851.51	0.00	1000
3	11 kV Sugar Bhaban Feeder.	4150753	1.00	IME	12892.43	13015.99	123.56	1000
4	11 kV Kamlapur(Madhumita via avisar)	4150741	1.00	IME	49009.3	49009.3	0.00	1000
5	11 kV Osmani Feeder		1.00	IME	33482.28	33482.28	0.00	1000
6	11 kV P & T S/S. Feeder	4150751	1.00	IME	345228.52	347692.50	2463.98	1000
7	11 kV Bangladesh Bank RMU.	4150738	1.00	IME	64271.26	64673.93	402.67	1000
8	11 kV Saidabad Water Treatment	4150749	1.00	IME	84547.36	85766.28	1218.92	1000
9	11 kV B.Bhabon DIT gate RMU.	4150743	1.00	IME	21518.24	21575.32	57.08	1000
10	11 kV DIT S/S Feeder	4150750	1.00	IME	173552.77	173552.77	0.0	1000

							0	
B	**Incomer from Transformer-2(GT-2).**	**4150742**	1.00	**IME**	1268875.00	1275946.70	**7071.70**	**1000**
1	11 kV BCIC Feeder	4150756	1.00	IME	170515.35	170515.35	0.00	1000
2	11 kV Sena Kalyan Feeder.	4150745	1.00	IME	60217.00	60881.36	664.36	1000
3	11 kV DIT RMU Fdr	4150740	1.00	IME	236821.24	238074.76	1253.52	1000
4	11 kV Janata Bank Feeder	4150755	1.00	IME	113101.57	113653.60	552.03	1000
5	11 kV Sonali Bank Feeder.	4150746	1.00	IME	65965.40	66469.18	503.78	1000
6	11 kV B.B.Hospital zone Feeder	4150739	1.00	IME	18373.93	18442.20	68.27	1000
7	11 kV PDB Design Feeder	4150747	1.00	IME	122494.80	123788.48	1293.68	1000
8	11 kV WAPDA Feeder	4150736	1.00	IME	92234.64	92343.88	109.24	1000
9	11 kV gopibagh O/H Feeder	4150735	1.00	IME	194814.27	194814.27	0.00	1000
10	11 kV B.Bhabon Staff Quarter Feder	4150737	1.00	IME	6942.20	7131.78	189.58	1000
11	AT -1	63412931	1.00	L&G	31521.80	31521.80	0.00	1
12	AT -2	63403117	1.00	L&G	53249.60	58428.00	5178.40	1

Table 3.6: Energy Balance Statement of Bangabhaban 132/11 KV sub-station.

3.5.5 Japan Garden 33/11 KV, 2X10/14 MVA SUBSTATION (NORTH)

SL	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
	Kallanpur (33 KV Side)	**33kv Import Unit**						
	Jigatala (JP garden)	**8993834**	**1.0**		**1072.051**	**1072.051**	0.000	180,000
1	**Satmosjid -2**	**8993669E**	1.0		**4092.285**	**4134.579**	42.29	180000
2	33 kv satmosjit-Japangarden city	86051	1.5		1524.50	1524.50	0.00	180,000
		33kv Export Unit						
	33 KV Japan Genden City	DHK15681	1.0		**17019.00**	**17019.00**	0.00	6000
	Japan Garden (33 KV Side)							
1	33 kV Kallyanpur-1(O/H)	532171	1.0		16.31	16.31	0.00	240000
2	33 kV Kallyanpur-2 (U/G)	DHK15681	1.0					6000
		86052	1.0		2925.36	2978.91	53.55	180000
	Japan Garden (33 KV X-FSide)							**Total**
1	33/11 KV Transformer No.1.	DHK61080	1.0		2506.58	2550.38	43.80	180000
2	33/11 KV Transformer No.2.	DHK61100	1.0		1700.17	1728.32	28.15	180000
	Japan Garden (11 kV Side)							**Total**
A	33/11 kV Transfomer-1 Incoming	DHK61079	1.0		3297.26	3357.57	60.31	160000
1	11 kV shia moszid	DHK60950	1.0		2088.80	2125.91	37.11	60000
2	11 kV Tajmohal Road	DHK60977	1.0		1246.30	1246.30	0.00	60000
3	11 kV Madrasha road	DHK61083	1.0		1077.51	1102.73	25.22	60000
4	11 kv Dhaka Uddan	DHK86067	1.0		2139.13	2195.89	56.76	60000
	11 KV Baitulaman Housing	DHK668115	1.0		2265.67	2308.03	42.360	60000
4	11 KV mohammodia housing	DHK60948	1.0		2391.54	2436.88	45.34	60000
5	11 kV chand housing	DHK60867	1.0		1438.93	1439.15	0.22	60000
B	33/11 kV Transfomer-2 Incoming	DHK61082	1.0		2757.62	2807.11	49.49	160000
	11 KV Shamoly Sq	DHK86063	1.0		259.36	265.64	6.28	30000

Table 3.7: Energy Balance Statement of Japan Garden 33/11 KV sub-station.

3.5.6 LALBAGH 132/33 KV S/S

0	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
1	132 kV Hasnabad Feeder	SIEM482	1.0	Import	2571896	2623560	51664	1000
			1.0	Export	18	18	0	1000
2	132 kV Kallyanpur -1 Feeder	SIEM485	1.0	Import	43332	43332	0.0	1000
			1.0	Export	6571	6571	0	1000
3	132 kV Kallyanpur -2 Feeder	SIEM490	1.0	Import	41443	41443	0	1000
			1.0	Export	6419	6426	7	1000
								TOTAL=>
4	132 kV Kamrangir char Feeder	SIEM491	1.0	Import	6797	6798	1	1000
			1.0	Export	244820	245317	497	1000
			1.0					TOTAL=>
1	132 kV T-1 (GT1)	SIEM494	1.0		1142003	1186279	44276	1000
2	132 KV T-2 (GT2)	SIEM499	1.0		1176413	1220813	44400	1000
33kv side								TOTAL=>
1	33KV Mitford Ckt-1	SIEM500	1.0		215489	218686	3197	2000
2	Bay302	SIEM513	1.0				0	1000
A	132/33 kV X-fmr Incoming-1	SIEM517	1.0		1186254	1212473	26219	1000
4	Bay304	SIEM503	1.0				0	1000
5	33/11 kV TransformerT1	SIEM502	1.0		572881	578692	5811	2000
6	33/11 kV TransformerT2	SIEM501	1.0		565730	571547	5817	2000
7	Bay309	SIEM507	1.0				0	1000
B	132/33 kV X-fmr Incoming-2	SIEM518	1.0		1221309	1247620	26311	1000
9	33 KV Lalbagh Old		1.0		5062	5116	54	2000
10	33KV Mitfort Ckt-2	SIEM511	1.00		230929	237667	6738	2000
11	33KV Azimpur-1		1.0		54240	58689	4449	2000
12	33KV Azimpur-2		1.0		40436	40436	0	2000
13	AT1		1.0		4678.92	4761.1	82.18	120
14	AT1		1.0		26230.6	26235.3	4.7	1000

Table 3.8: Energy Balance Statement of LALBAGH 132/33 KV sub-station

3.5.7 FATULLAH 33/11KV, 4 X 10/14 MVA SUBSTATION

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
	Shyampur (33 kV Side)							
1	33 KV Fatullah Feeder No.1. Via DAPA	83796210	1.0	Siemens	159.67	159.67	0.00	180000
2	33 KV Fatullah Feeder No.2.	08993912	1.0	L&T	1900.35	1900.35	0.00	180000
3	33 KV Matuil-Fatullah 1	08993575	1.0		3110	3169	59.935	180000
4	33 KV Matuil Fatullah Circuit-2	HA021100940-02	1.0	ION	3258	3312	54.016	0
	Pancabati BISIC (33 kV Side)							**Total=>**
1	33 kV Fatullah Feeder (O/H) At BASIC	HA030800161-03	1.5	Import	680.41	680.41	0.00	1000
		HA030800161-03	1.5	Export	1240.25	1240.25	0.00	1000
		DHKA2188	1.5	Export	6.2056	6.2056	0.00	180000
		DHKA2188	1.5		0.0000	0.0000	0.00	180000
	Fatullah (33 kV Side)							**Total=>**
1	33 kV Shyampur Feeder-1	DHK60866	1.0	Secure	802831.100	836146.500	33315.40	240
2	33 kV Shyampur Feeder-2	DHK61076	1.0	Secure	821748.500	861313.900	39565.40	240
3	33 kV Panchabati BSCIC Feeder	DHK61077	1.0	Secure	191203.300	191203.300	0.00	240
4	33/11 kV, 20/28 MVA T-1 (HV)	DHK60980	1.0	Secure	779247.800	812478.900	33231.10	240
5	33/11 kV, 20/28 MVA T-2 (HV)	DHK60952	1.0	Secure	29608.900	47830.700	18221.80	240
	Fatullah (11 kV Side)							**Total**
	11 KV Minan steel feeder		1.0		48373877	49093628	719751.00	1
	11 KV shovon garments		1.0		44612312	45706926	1094614.00	1
1	11 KV Mazar O/H Feeder	DHK61059	1.0	Secure	544639.400	570709.900	26070.50	60
2	11 kV Haque Steel & Shilpi Steel .	DHK61111	1.0		598502.500	612350.700	13848.20	60
3	11 kV Shahjahan Steel.	DHK61055	1.0		969953.400	979491.400	9538.00	60

4	11 kV Al-baraka & Shah Fatullah.	DHK61114	1.0		904205.900	922681.900	18476.00	60
5	11 kV Pilkuni O/H Feeder.	DHK61058	1.0		285979.000	314778.600	28799.60	60
	11 kV Panchabati O/H Feeder	HA021100891-02	1.0		58396185.00	60966432.00	2570247.00	1
6	11 kV Dharmagonj Feeder.	HA021101231-02	1.0		292930.00	1688613.00	1395683.00	1
	11 kV Sena Edible Oil Feeder.	HA021101108-02	1.0	ION	1461110.00	1681658.00	220548.00	1
7	11 kV Post Office Road Feeder.	DHK61053	1.0		570548.20	582661.10	12112.90	60
A	33/11 kV Transformer-1 Incoming.	DHK61060	1.0		633187.800	676212.300	43024.50	180
B	33/11 kV Transformer-2 Incoming.	DHK61054	1.0		758677.200	782990.100	24312.90	180
8	11 kV Narayangonj Express Feeder.	DHK61052	1.0		795501.300	821871.900	26370.60	60
9	11 kV Fatullah Feeder.	DHK61056	1.0		15063.800	29493.400	14429.60	60
10	11 kV Kutubail Feeder	HA021101010-02	1.0		52062515.00	53054759.00	992244.00	1
	11 kV Aligonj Feeder	HA021100973-02	1.0		13396932.00	13690342.00	293410.00	1
11		HA1100973-02	1.0		27184990.00	27184990.00	0.00	1
C	33/11 kV Transformer-4 Incoming.	DHK61051	1.0		527553.70	555337.00	27783.30	90
D	33/11 kV Transformer-3 Incoming.	DHK60924	1.0		724582.50	750734.80	26152.30	90
12	11 kV Hossain Steel Feeder.	HA021101108-02	1.0		2669.00	2669.00	0.00	1
		06604344	1.0		500.75	500.75	0.00	40000
13	11 kV Gabtoli Feeder	HA021101005-02	1.0		34249421.00	35169304.00	919883.00	1

Table 3.9: Energy Balance Statement of FATULLAH 33/11KV sub-station

3.5.8 BIDDUT BHABON 33/11 KV S/S NORTH -1

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
4	33 kV MOTIJHEEL INCOMING		1.00		53535.8	79448.21	25912.41	270
5	33kV Transformer (T-1)		1		83413.3	91593.1	8179.8	270
6	33kV Transformer (T-2)		1		68697.9	86431.95	17734.05	270
A	11 kV T-1 Incoming	DHK-C9316	1.0		31876.7	40897.55	9020.85	180
1	NORTH BUS(Ramna1)		1.0		51707.5	54445.04	2737.54	60
2	11 KV Family Planning		1.0		63377.07	77376.4	13999.33	60
3	11 KV Muktijoddha jadughor		1.0		64263.3	80318.15	16054.85	60
4	SOUTH BUS(Ramna2)		1.0		43915.09	65824.6	21909.51	60
5	11 KV Shegun Bagicha		1.0		73220.7	84308.65	11087.95	60
6	11KV Old Palton		1.0		22428.9	37422.73	14993.83	60
7	Tip Top		1.0		58581.9	90386.12	31804.22	60
7	AT		0.4					
B	11 kV T-2 Incoming	DHK-C9377	1.0		39641	59565.45	19924.45	180

Table 3.10: Energy Balance Statement of BIDDUT BHABON 33/11 KV sub-station

3.5.9 BSMMU 33/11 KV, 2*28/35 MVA GIS SUBSTATION (NORTH 1)

Sl	Name of S/S. (Voltage level)	Meter		METER	Meter Reading		Diff.	OMF
No.	Name of Feeders.	Number	CF	Make	1/9/2019	1/9/2019		
	Dhanmondi (33 KV Side)							
1	33 kV Dhanmondi Incoming Circuit-1	BD017073	1		0.00	21.94	21.94	240000
	33 kV Dhanmondi Incoming Circuit-2	BD017074	1		26.63	28.03	1.40	240000
	BSMMU (33 KV Side)							Total
1	33/11 kV, 28/35 MVA T-1 (HV)	BD017072	1.0		7078.52	9954.00	2875.48	888.89
2	33/11 kV, 28/35 MVA T-2 (HV)	BD017076	1.0		29.03	29.03	0.00	888.89
3	33/11 kV, 28/35 MVA T-3 (Future)	BD017075	1.0		0.26	0.26	0.00	888.89
								Total
	BSMMU (11 kV Side)							
A	11 kV Holi Family Feeder (F5)	BD017077	1.0		1135.65	1605.09	469.44	2000
1	11 kV Paribagh Feeder (F7)	BD017079	1.0		1979.40	2802.49	823.09	2000
3			1.0				0.00	
4			1.0				0.00	
5			1.0				0.00	
6			1.0				0.00	
7			1.0				0.00	
8	33/11 kV, 28/35 MVA T-1 (LV) Incoming	BD017081	1.0		6231.29	8710.58	2479.29	1000
9	33/11 kV, 28/35 MVA T-2 (LV) Incoming	BD017082	1.0		55.16	194.20	139.04	1000
10			1.0				0.00	
11			1.0				0.00	
12			1.0				0.00	
13	11 kV Secretary Quarter RMU (F11)	BD017085	1.0		0.05	0.05	0.00	2000
14			1.0				0.00	
17			1.0				0.00	
18	11/0.4 kV Aux. Transformer, AT-1	DHKD4418	1.0		68.00	68.00	0.00	100

Table 3.11: Energy Balance Statement of BSMMU 33/11 KV sub-station

3.6 Calculation

- ✓ Meter Consumption = Reading difference × OMF × CF
- ✓ CF = Correction Factor
- ✓ Overall Multiplication Factor (OMF) = $\frac{\text{Line CT ratio} \times \text{Line PT ratio}}{\text{Meter CT ratio} \times \text{Meter PT ratio}}$ × DMF
- ✓ DMF = Dial Multiplication Factor

CHAPTER 4

ABB SCADA

(SUPERVISORY CONTROL AND DATA ACQUISITION)

4.1 SCADA

Supervisory control and data acquisition (SCADA) is an arrangement of programming and equipment components that permits modern associations

4.2 Purposes of SCADA

SCADA systems are critical for modern associations since they help to maintain proficiency, process information for smarter decisions, and convey system issues to help moderate vacation**.**

- Control industrial procedures locally or at remote areas
- Monitor, accumulate, and process real time information
- Directly connect with gadgets, for example, sensors, valves, Pumps, engines, and increasingly through human-machine interface (HMI) programming
- Record events into a log document

4.3 Scope of SCADA:

- Distribution Outage Management and Restoration
- Distribution Operation Management

- Demand side Management
- System Control and Protection (Integration with SAS)
- Reactive Power and Voltage Management
- Distribution Planning (Integration with GIS)

4.4 Demand Side Management

- Peak Load Forecasting
- Execution of Load control strategies
- Demand Balancing according to Supply
- Intelligent demand forecasting based on previous power flow data

4.5 Distribution Planning (Integration with GIS)

- Data analysis for decision making
    - Real-time and historical data plotting of graphs, charts, trends, etc.
- Future Distribution network expansion
- Planning of Future Grid, Substation & Feeder
- Manageable network
- Reporting

4.6 Overview of SCADA System

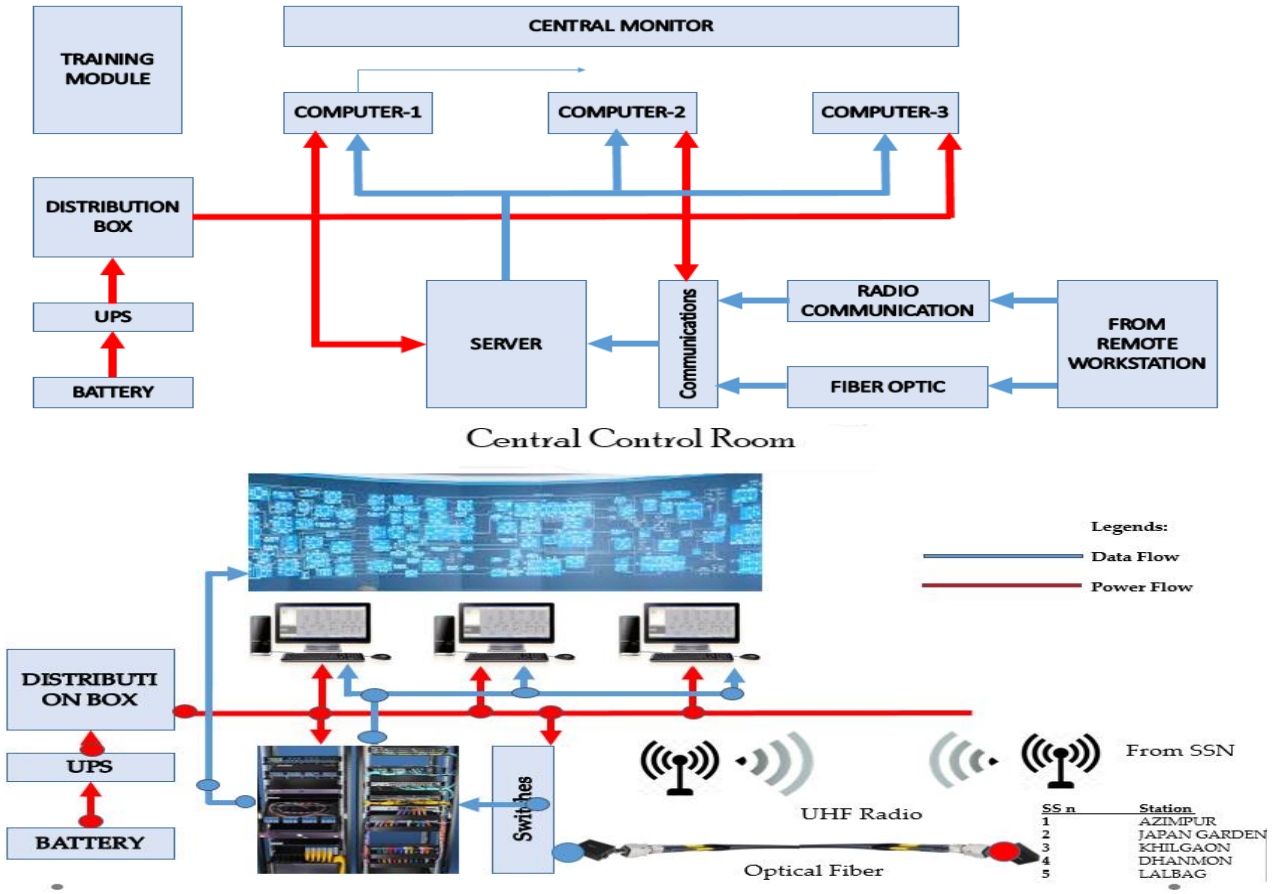


Fig 4.1: Proposed Central Control Room with Block Diagram

4.7 Summary of Control Room Equipment

- Servers
- Workstations
- Network Equipment
- Firewalls
- Firewall For ABB Support
- Other Devices

- Software
- Operating System
- Office
- Database

4.8 Remote Workstations Equipment

- Industrial gateway SYS600C Workstations
- Cubicle
- Managed Industrial Ethernet switch
- GPS Clock
- MCBs and other
- LAN-cables
- F/O cables
- Laser color printer
- Monitor
- keyboard and mouse
- 33KV relay for Line, Feeder and Transformer BCU
- Relay for 11kV Feeder BCU
- Installation accessories (11KV)
- UHF Radio Equipment
- Antenna System
- Fiber optic connection
- Coaxial Cable
- Installation Kit

- Feed line cable
- Coaxial overvoltage protection
- SFP Module
- Installation accessories (33KV)

4.10 SCADA Pilot Project in 5 Sub-Stations

SL	Sub-Station Name	Comments
1	Mogbazar 132/33/11KV	VPN connectivity is available though Leased Fiber Optic connection. VPN connectivity is available though Leased Fiber Optic connection.
2	Lalbagh 132/33/11 KV	
3	Japan Garden 33/11KV	
4	Azimpur 33/11 KV	
5	Khilgaon 33/11KV	

Table 4.1: Supervisory Control & Data Acquisition pilot Project substation list

4.11 ABB SCADA System Control and Protection (Integration with SAS)

- Remote Operation & Control
- Identify Fault Location
- Relay configuration
- Ensure Protection of Equipment Remotely

- Integration with DPDC'S SAS
- Advanced fault detection
- Events, Alarm summery & Alarm history
- Logging and Archiving

4.12 Reactive Power and Voltage Management

- Monitor real data (Frequency and Power Factor)
- Take immediate step to stable the power system keeping voltage & frequency within the limits
- Using the data for planning and implementation to compensate reactive power lose.
- Controlling the capacitor banks and voltage regulators to provide a good voltage at the real time.
- Reducing energy losses by minimizing reactive power flows

4.13 Distribution Operation Management

- Load Forecasting, load flow and Short circuit calculation
- Re-allocated load and optimization of Distribution network and Substation
- Identify strength and weakness of distribution network
- Measure the effectiveness of maintenance team
- Assist management for planning

4.14 Summary of Revised Price Proposal of SCADA

Sl No	Station Name	SCOPE	Total Price (CIF)	% with Equipment	Total Price
1	**Azimpur 33/11 KV SS (33KV Breaker-7 11KV Breaker-16 Total=> 23)**	-New Realy Installation -Local SAS -Fiber & Radio Communicaiton -GPS -Workstation etc	**294,233**		**398,174**
		Design and Project Management SAS	**28,385**	**10**	
		Telecom installation	**14,021**	**25.68**	
		Installation and Implementation for SA	**61,535**		
2	**Japan Garden 33/11 KV SS (33KV Breaker-6 11KV Breaker-15 Total=> 21)**	-New Realy Installation -Local SAS -Fiber & Radio Communicaiton -GPS -Workstation etc	**256,896**		**329,689**
		Design and Project Management SAS	**28,385**	**11**	
		Telecom installation	**14,021**	**17.29**	
		Installation and Implementation for SA	**30,387**		

3	**Khilgaon 33/11 KV SS (33KV Breaker-7 11KV Breaker-13 Total=> 20)**	-New Realy Installation -Local SAS -Fiber & Radio Communicaiton -GPS -Workstation etc	**268,427**		**341,220**
		Design and Project Management SAS	**28,385**	**11**	
		Telecom installation	**14,021**	**16.54**	
		Installation and Implementation for SA	**30,387**		
4	**Dhanmondi 33/11 KV SS (33KV Breaker-19 11KV Breaker-23 Total=> 42)**	33/11KV -New Realy Installation -Local SAS -Fiber & Radio Communicaiton -GPS -Workstation etc	**343,259**		**385,665**
		Design and Project Management SAS	**28385.4**	**8**	
		Telecom installation	**14,021**		
		Installation and Implementation for SA			
5	**Lalbag 33/11 KV SS (33KV Breaker-0 11KV Breaker-17 Total=> 17)**	33/11KV -New Realy Installation -Local SAS -Fiber & Radio Communicaiton -GPS -Workstation etc.	**266,960**		**309,366**
		Design and Project Management SAS	**28,385**	**11**	
		Telecom installation	**14,021**		
		Installation and Implementation for SA			

Table4.2: Revised Price Proposal of SCADA

Fig 4.2: Location of Sub-station (SCADA pilot Project of DPDC)

4.16 Azimpur (33/11 kV)

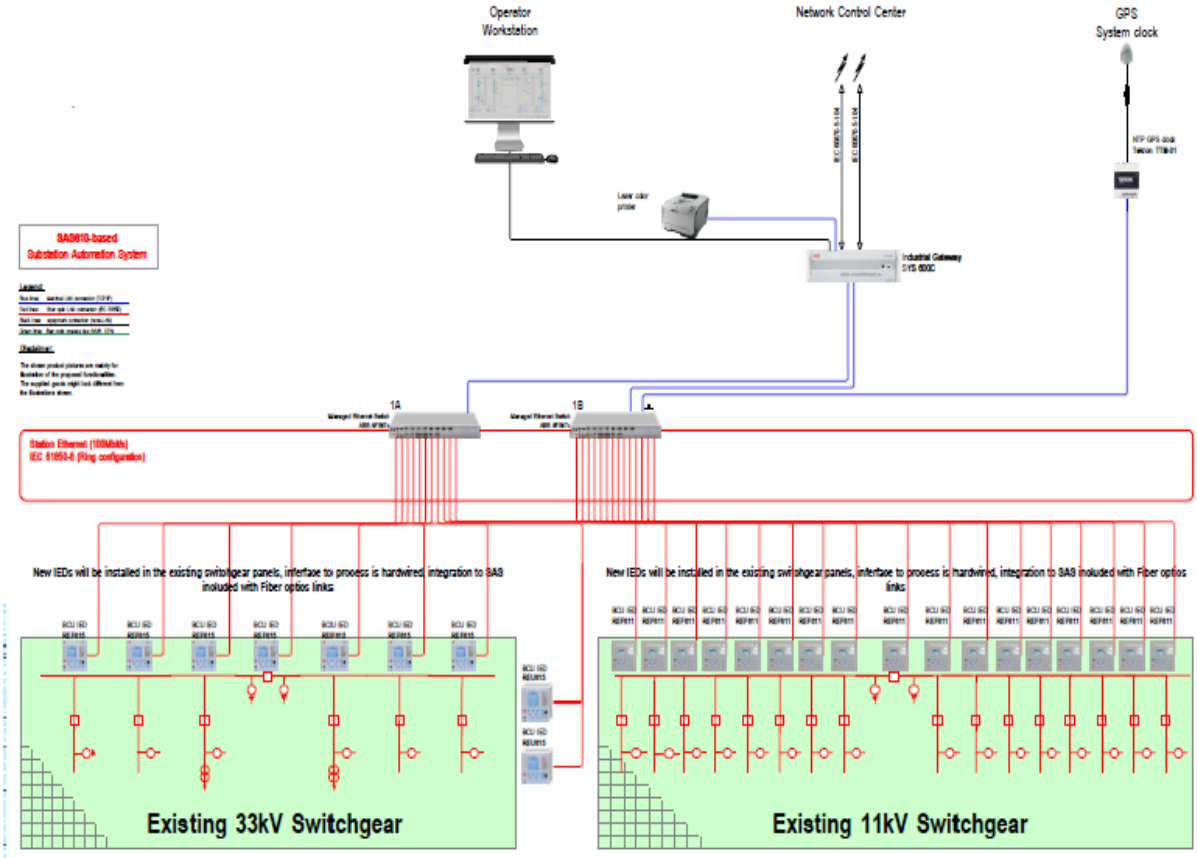


Fig 4.3: Substation Automation System

4.17 SCADA for DPDC (Implementation)

4.17.1 Upgraded SCADA system in 2 steps

1. SCADA project delivery

(i) New SCADA system with 5 substations

(ii) 100% SCADA functionality where signals are available for HV and MV

(iii)DMS functionality and GIS import

(iv) Extensive training for operators and maintenance personnel

2. Separate project

(i) Full deployment with all substations and larger communication network

(ii) DMS applications for the entire MV/LV network

Fig 4.4: SCADA system for DPDC

4.18 Benefits from Pilot and beyond (MV/LV control and visualization)

Pilot Project

The delivery project for 5 substations include the following project items:

• Distribution Management support.

• Leverage existing network data investments by GIS import.

• Main Pilot project delivery in 12-18 months, training & extensive support to utility personnel.

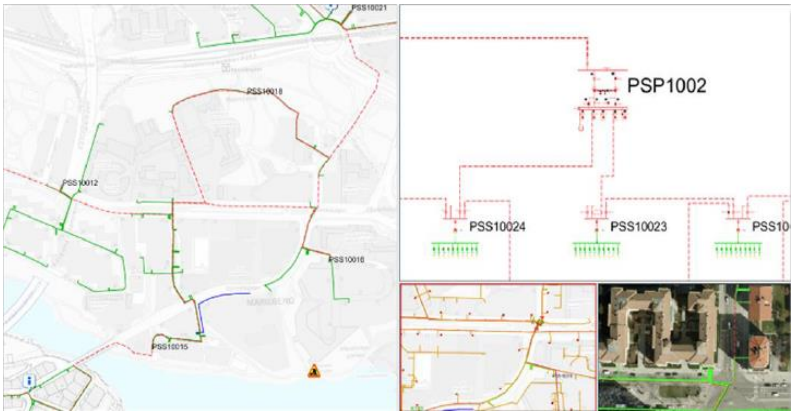


Fig 4.5: Visualization of 5 Substations Delivery Project

Next Steps

• Create a single, common network asset registry and network presentation in geographical and schematic maps, for overhead and underground network (in the future) that will be used in the complete Organization.

• Build a network model that is a foundation for all network analytical applications. With the help of these applications it is then easier to improve network planning process, optimize network configuration and improve outage restoration process.

• Expand SCADA DMS into all the Utility regions.

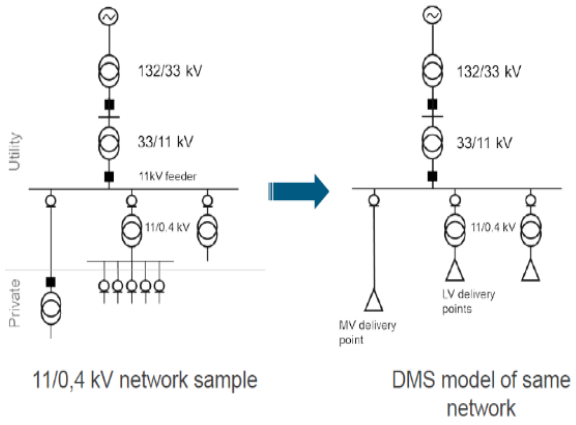


Fig 4.6: Transformation of Substation

4.19 Intranet Connection

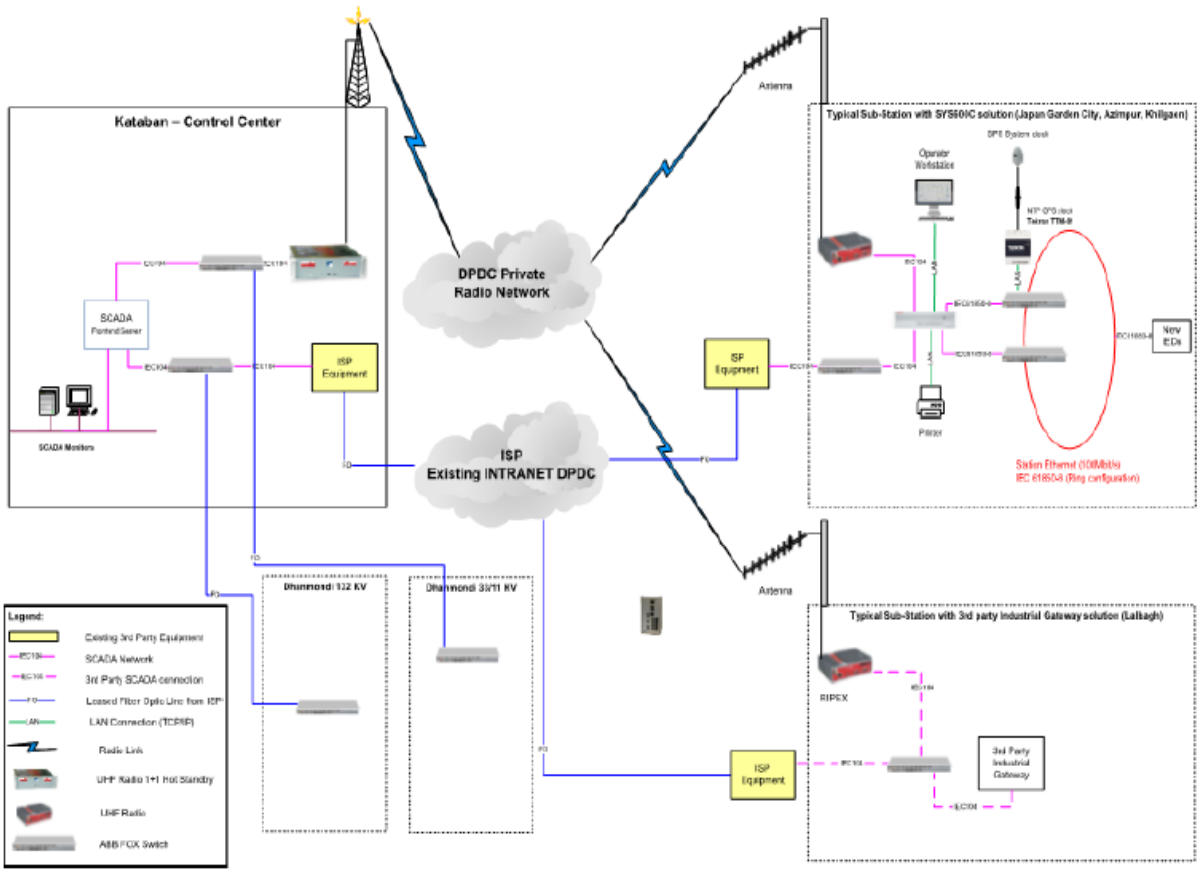


Fig 4.7: DPDC Private Network (Intranet Connection)

4.20 Benefit of SCADA

1. Black out Prevention & Quick Restoration.
2. Load flow analysis & forecasting.
3. Improved monitoring and controlling.
4. As SAS, GIS, Smart IED & SMART Grid replacing the existing substation & gird.

CHAPTER 5

DIGITALIZATION AND AUTOMATION OF SUB STATION METERING SYSTEM (DASMS)

5.1 Digitalization and Automation of Sub Station Metering System (DASMS)

Digitalization means computerization of systems and jobs for better ease and accessibility.

Automation means the use of largely automatic equipment in a system of manufacturing or other production process.

DASMS means Digitalization and Automation of Sub-Station Metering System, it's a complete automatic system which is used substation.

5.2 Intention of Digitalization and Automation of Sub Station Metering System

In the near past, we used analog meter in substations. Now a days everything is depends on science & technologies. So therefore, we are using digital equipment in substation system. Before Digitalization and Automation of Sub Station Metering System (DASMS) we were collect meter reading manually to go through substation. After using DASMS we can collect data completely computer based by the through of a server. We do not need to go substation to collect data.

5.3 DPDC controls every substations from one point

- Old meter replacement
- Every smart meter have IP address
- Ethernet (104)
- Router (local station)
- Intranet Network system
- Control room

5.4 Control Diagram of Digitalization and Automation of Sub Station Metering System

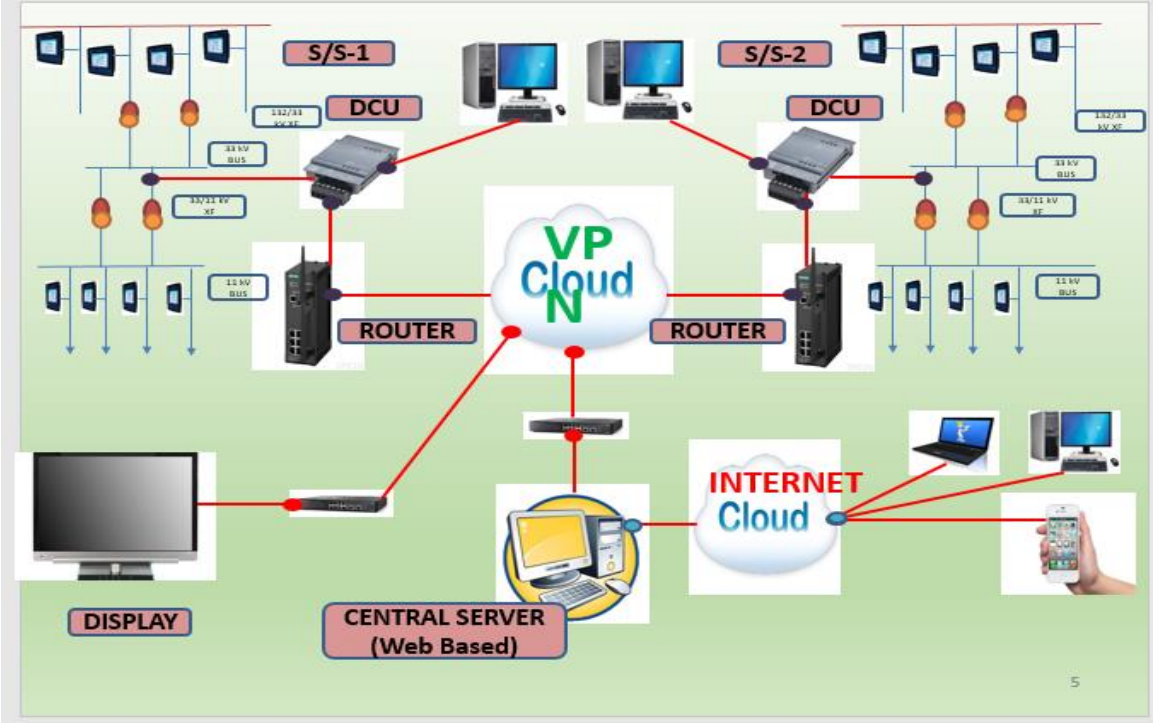


Fig 5.1: Control Diagram of Digitalization and Automation system

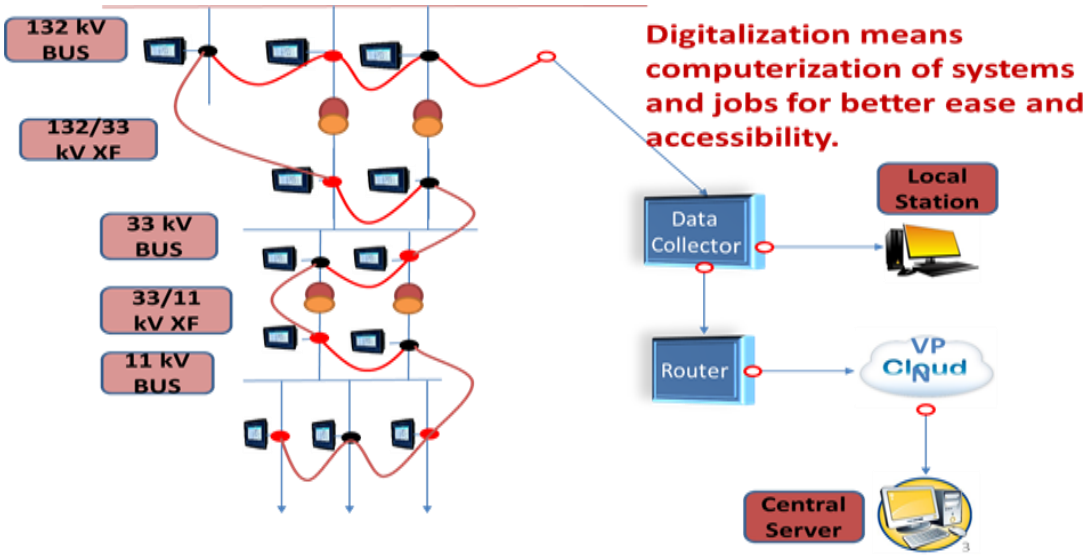


Fig 5.2: Digitalization and Automation system

5.5 OPERATION OF DASMS

Every transformer connected with a four quadrant energy meter. Every meter connected to each other by the through of Data Collector Unit. Data collector unit connected with local station server & a router. Now the router is connected with Virtual private network cloud (VPN). Cloud VPN is a kind of VPN that uses a cloud-based system foundation to convey VPN administrations. It gives all around available VPN access to end clients and endorsers through a cloud stage over open Internet. Cloud VPN is also known as hosted VPN or virtual private network as a service. All the sub stations connected with a central server (web based).Now central server connected with VPN cloud and internet cloud connected with central server. Therefore every user can connected with internet cloud. Above all every user can see the update data of the sub substation.

5.6 SCOPE OF (DASMS)

- Energy auditing add different voltage level
- Automatic energy balancing
- Energy accounting
- Energy conservation
- System Management
- Duration of load shedding from breaker status
- Checking the consumption of tariff meters receiving point
- Facility of automatic collection and store data such as (voltage, current, power factor, KWH, KVAR, KVA) hourly, daily, monthly, yearly basis.

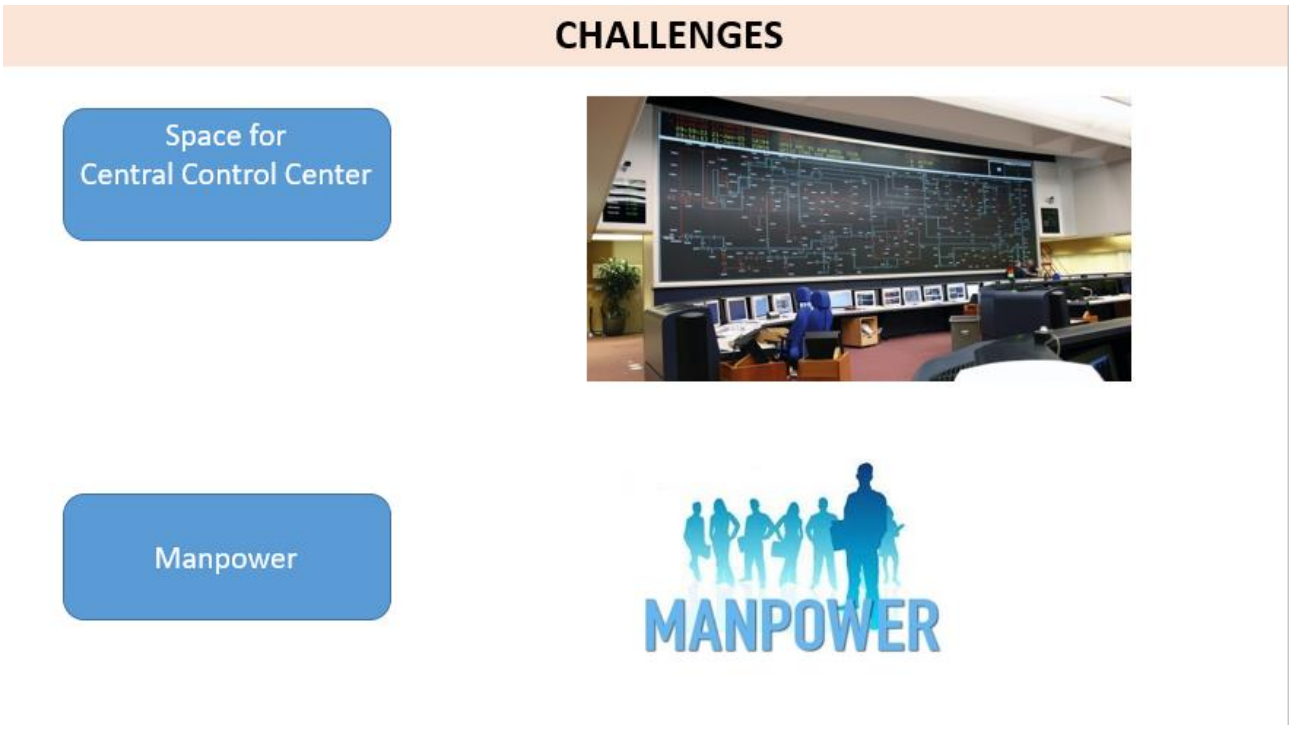
5.7 Comparison of DASMS, GIS & SCADA

Subject	DASMS	GIS	SCADA
Energy Reading	YES	NO	NO
Sub-Station Energy Balancing	AUTOMATIC	NO	NO
Cumulative Load Profile	YES	NO	NO
Global Position	NO	YES	NO
Fault Information	NO	NO	YES
Supervisory Control	NO	NO	YES
Data Source	ENERGY METER	GPS	COUPLING RELAY
Data Accessibility	OPEN FOR ALL AUTHENTIC PERSONS	LIMITED	RESTRICTED

Table 5.1: Comparison of DASMS, GIS & SCADA

5.8 Benefit of Digitalization and Automation of Sub Station Metering System (DASMS)

- It will be possible to receive energy readings at 00.00 hours as per PDB.
- Monthly bills of PDB and PGCB can be accurately deducted.
- SMS Alert for VIP Feeders.
- Server based Data Archive
- Disputed PFC bill passed by PDB can be amended.
- The power factor of DPDC network can be improved by establishing customer and feeder based capacitor bank.
- Various tasks can be done including load flow, load management, planning-design.
- Energy balance of all sub-stations can be completed quickly and accurately.
- In the interest of accurate energy accounting, information about the CT-PT shutdown of a feeder, change of source, change of phase sequence, etc. will be obtained correctly.
- Import units can be accurately transmitted to 36 NOCs in the fastest time.
- All energy accounting information can be stored and paperless on the server.
- It will be possible to calculate the amount of loss in different sections of the line and sub-station.
- Acquisition of API targets will be accelerated.
- Accuracy and mobility will come in the work of DPDC.



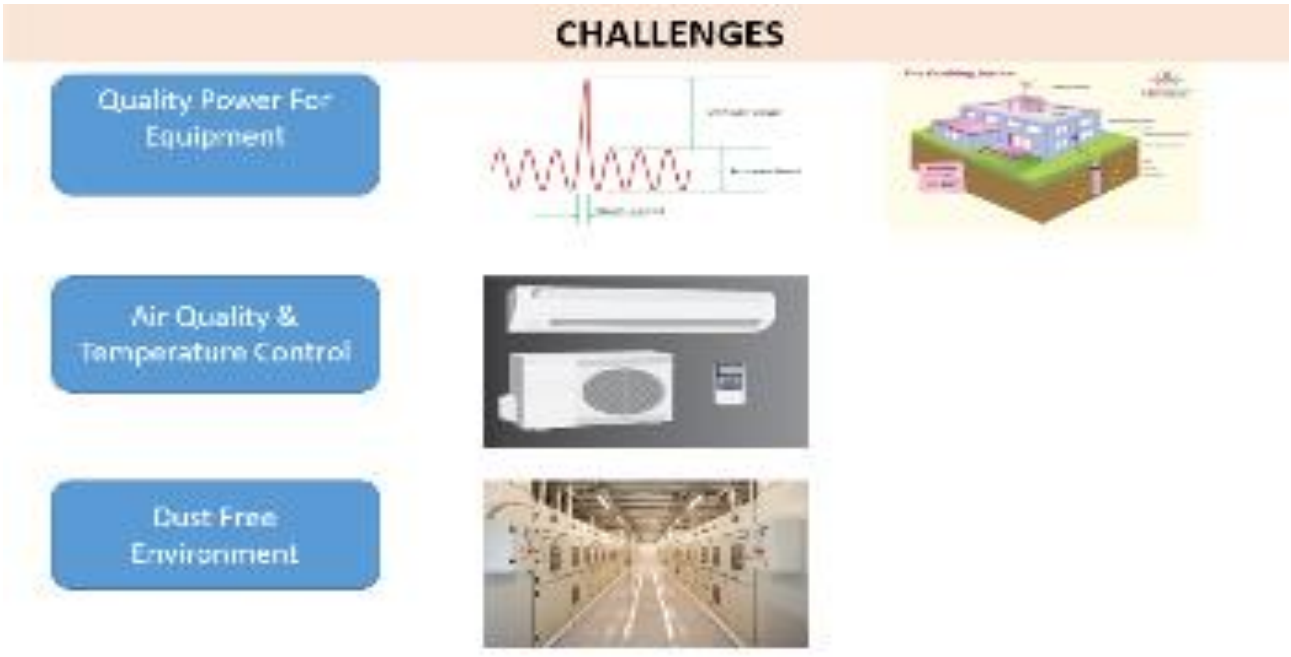


Fig5.2: Challenges of digitalization and automation of substation metering system

CHAPTER 6
METERING SYSTEM

6.1 Introduction of Metering System

A Metering System is comprised of things of Metering Equipment; voltage transformers, current transformers, Meters and Outstations, the wires and connections between everything and connections required to move metered information to the outside world (for example modems and correspondence lines).

6.2 Energy Meter

An electric meter, or energy meter, is a device that estimates the measure of electric energy consumed by a structure, occupant space, or electrically powered equipment.

6.3 Importance of Energy Meter

Accurate energy bills are a significant factor for dealing with the household finances, particularly in these difficult times. Without normal meter readings all energy companies can do is to estimate utilization. In the event that more has been utilized, more than evaluated, at that point this can be a shock for the consumer meter reading is one of the most important parts of energy supply. Readings must be dependable and exact so your bills can be as well.

6.3.1 Visibility

The significance of smart meters for the visibility of data for purchasers lies in the way that with current conventional meters it is simple for householders to utilize more energy than they really need. However, smart meters qualify consumers to see precisely how much energy they are utilizing and when they are utilizing it.

6.3.2 Savings

These Characteristics qualify smart meters to help customers save money on electric bills. At present, householders receive estimated charges after the energy has been utilized. This makes challenges in that it is often very difficult to compare expenses with usage. Sometimes, energy suppliers will provide online equipment for customers who install smart meters in their homes or businesses. These online equipment are planned at helping consumers to deal with their energy usage more proficiently.

6.3.3 Accuracy

Smart meters send precise data through to the power organization, taking out the need to make estimates. They are thoroughly tried even before they leave the manufacturing company, so there is no confusion about this. However, energy providers will likewise offer to test smart meters in the home when required to guarantee the meter is doing what it should and giving exact data.

6.4 Types of Energy Meter

There are two types of energy meter. Such as,

- Substation Meter or Grid Meter
    - Four Quadrant Meter
- Consumer Meter
    - Analog Meter
    - Digital Meter
    - Prepaid Meter

6.5 Substation Meter or Grid Meter

6.5.1 Four Quadrant Meter

Power is generated by producing stations and transmitted to load centers from where it is distributed to end purchasers. These load focuses are constrained by distribution utilities and there is a between change of energy between various utilities associated with the grid.

The trading of power is complex in such circumstances and four quadrant energy estimations are expected to precisely measure the active and reactive energy under various export/import conditions for both active & reactive energy.

Fig 6.1: Four Quadrant Energy Meter

6.5.2 Application

EQM is four quadrant power meter intended for direct and transformer estimations in 3 and 4 wire power organize. On account of EQM's complex expanded usefulness and high exactness, the meter is expected to be utilized in high voltage estimating frameworks of power plants, utilities and industry estimating frameworks.

Fig 6.2: Rating of Four Quadrant Energy Meter

6.5.3 Active Energy

The loads are included of a combination of inductive load, resistive load and capacitive load. The present vector can be maximum 90 away from the voltage vector when the load is either inductive or capacitive. It is in-phase with voltage when load is resistive. At the point when the edge between the voltage and active segment of current is 0 degrees, the power stream is considered as “active import”. All energy recorded by the energy meter for this sort of intensity stream is recorded as “import energy”. The current vector lies in either quadrant 1 or 2, active energy is being expended. The quadrants characterized in IEC for active energy import are 1 & 4.At the point when the angle between the voltage and active component of current is 180 degrees, the power stream is considered as “active export”. All energy recorded by the energy meter fort his sort of intensity stream is recorded as “active export energy”. The current vector lies in either quadrant 3 or 4 active energy is being generated. The quadrants characterized in IEC for active energy send out are 2 & 3.

6.5.4 Reactive Energy

When the angle between the voltage and reactive component of current is π/2 degrees, the power stream is supposed as "reactive import". All power recorded by the vitality meter for this kind of power stream is filed as "import of reactive energy". When the load is capacitive, the voltage vector lags the current vector. The current vector hence stays in Quadrant 2 or 3 depending on whether the capacitive load is import or export, and the quadrature component of the load current is either at a π/2 angle or 270 as for the voltage vector. This reactive energy is called Reactive energy capacitive. At the point when the angle between the voltage and reactive component of current is 270 degrees, the power stream is supposed as "reactive export". All energy filed by the energy meter for this kind of power stream is filed as "active export energy".

Two types of reactive power, Such as:

(a) Capacitive power and

(b) Inductive power.

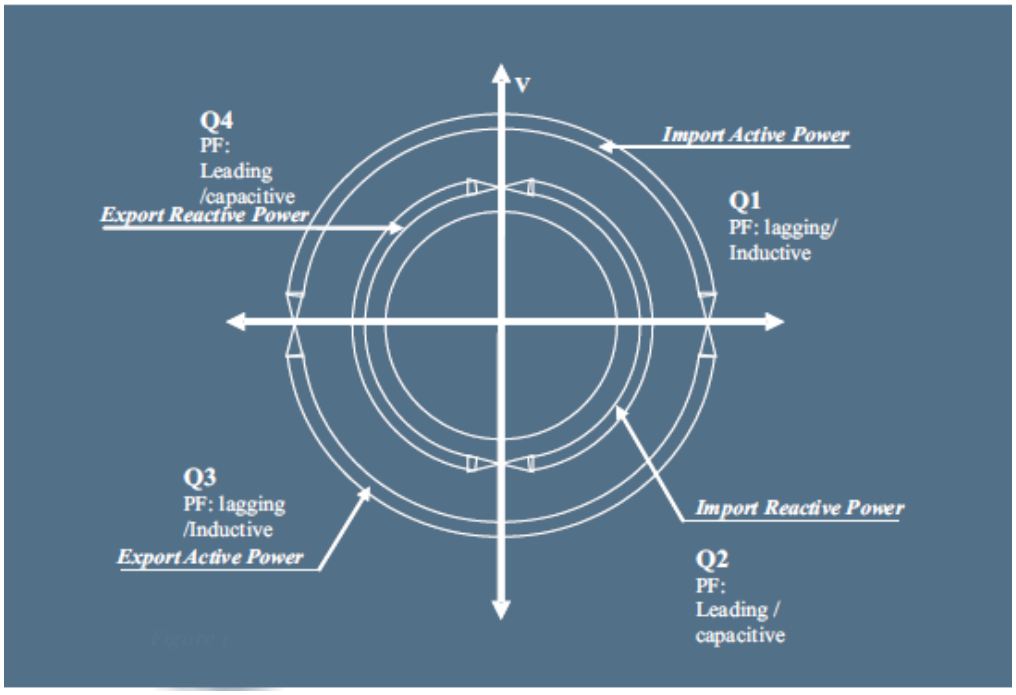


Fig 6.3: Four Quadrant Energy Cycle

6.5.5 Working Principle:

In Quadrant 1: Active energy is considered as import, reactive energy is too considered as import. This is called reactive while active import. The power factor of this sort of burden is a lagging power factor.

In Quadrant 2: Active energy is considered as import, however reactive energy is considered as export. This is called reactive while Active import. The power factor of this kind of leading is a power factor.

In Quadrant 3: Active energy is considered as export, reactive energy is additionally considered as send out. This is called reactive while Active export since this is a perfect representation of inductive import (of quadrant 1). The power factor of this sort of burden is a slacking power factor.

In Quadrant 4: Active energy is considered as send out or export, yet receptive energy is considered as import. This is called reactive while active export since this is a perfect representation of reactive import of quadrant 2. The power factor of this sort of burden is a main force factor.

6.5.6 Communication interfaces

EQM meter is furnished with interfaces: optical CLO or RS485. The meter might be also furnished with communication module: (for GSM transmission), RS485, CLO, RS232.Access to the communication module is secured via fixed terminal box cover.

6.5.7 Metering information

Every one of the information enrolled by the meter is customer friendly exhibited on the LCD applying OBIS standard. All information screens might be seen physically utilizing joystick that is accessible on the front board of the meter. Extraordinarily structured, graphical LCD of the meter permits introduction of numerous information on a similar screen. There are four essential LCD menus:

• Current information – access to current estimating information.

• Archives information – access to authentic estimating information.

• Momentary qualities - access to transitory current estimations.

• Preset – meters setup and presets. LCD screen is furnished with outer attractive field pointer.

6.6 Consumer Meter

An electric energy meter is a device that calculate the electric energy consumed by consumer powered apparatus.

6.6.1 Analog Energy Meter

Analog energy meters are those gadget which are utilized to compute the pre-owned wattage or unit of power. Analog meters takes a shot at magnetic gadget which continues moving a roundabout ring. That ring when complete one circle implies one unit of power is utilized.

Fig 6.4: Analog Energy Meter

6.6.2 Digital Energy Meter

Digital energy meter is a device that calculate the consumers used electricity. Digital energy meter count the electricity by blinking a LED light 1600 times to calculate an unit (kilo-watt-hour). It has a LCD display which demonstrate the consuming energy of a consumer.

Fig 6.5: Digital Energy Meter

6.6.3 Prepaid Energy Meter

Prepaid system is a two-way communication method. A customary electronic prepaid metering system operates on three levels. First the meters installed at customer's house. The next level is the vending station situated at utility's offices or at appointed agents. The communication between vending stations and the meters is in the form of token, which is used to top up the credit in the meter.

- Prepayment meters usually accept tokens or cards that can be bought or topped up respectively.

- Customer stops paying for electricity, the electricity supply will be cut off by a relay fitted into the meter.
- The advantage of this kind of meter is that you can budget for how much electricity you use by paying for it before you use it.

Types of Prepaid meter

Two types of prepaid meter such as:

1. Keypad Type.
    - Currency transfer
    - Unit Transfer
2. Smart Card Type.
    - Currency Transfer

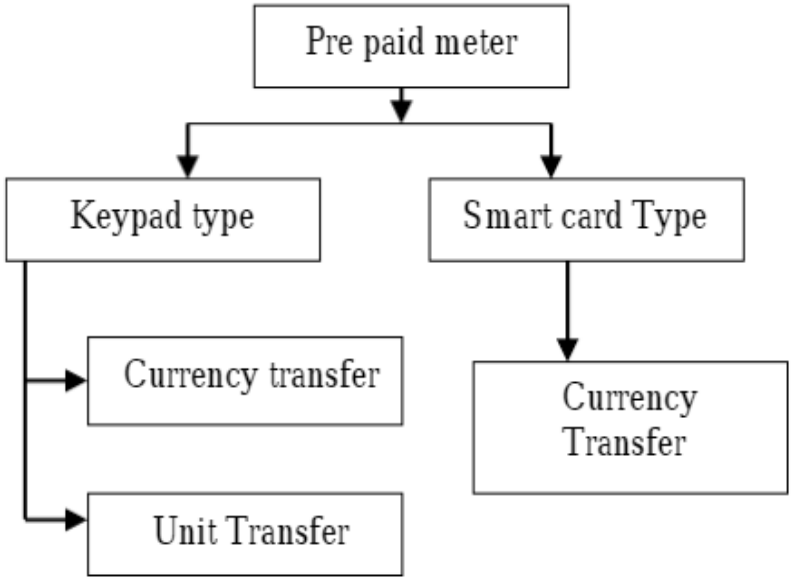


Fig 6.6: Types of Prepaid Meter

Fig 6.7: Smart Card Type prepaid meter

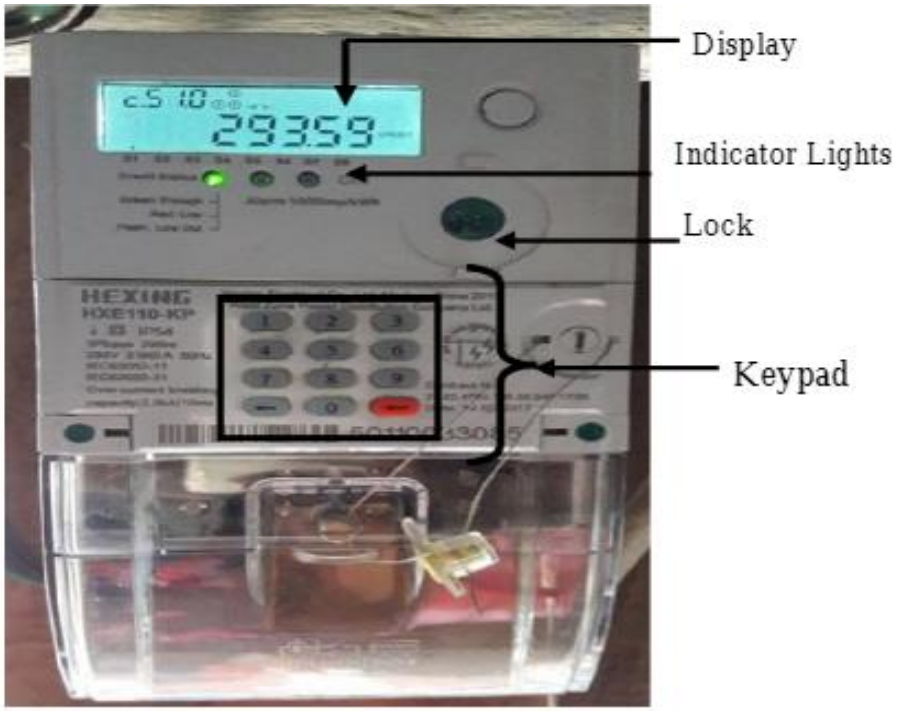


Fig 6.8: Keypad Type Prepaid Meter

CHAPTER 7
CONCLUSION

7.1 Discussion

At DPDC, we have put some great days in our entry level job plan. For the electrical and electronic engineers in our country, DPDC is outstanding among other things. We should state the speculations that we have learned at our University was for all intents and purposes seen by us at DPDC. It allowed us a chance to actualize our hypothetical information in for all intents and purposes. Our accomplishments from DPDC are as per the following:

• Industrial produce given by DPDC has improved our handy information.

• It has augmented our reasoning limit about down to earth activities of the distinctive gear.

• It has expanded our certainty level for confronting prospective employee meet-up in future.

• DPDC gave us a special affair of watching the hardware of substation.

The well-disposed condition in DPDC energized us to co-work with one another. We have taken in a great deal and got reasonable learning amid our temporary position at DPDC which will help us in future life.

7.2 Problems

We have authoritatively gathered some finding out about DPDC's practical exercises. However, inside the compelled time it was incredibly inconvenient undertaking to assemble the entire learning about everything. In view of some security issue we was unable to get enough pictures and enough finds a workable place. In light of some specialized shortcoming, visiting and gathering a few insights regarding two of our exhorted substation was very upsetting. When we collect meter reading we also face some problem.

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