

A comparative Study of System Data (Percentage of Loss) of Rural Electrification Board for some specific PBS Zone in Bangladesh

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Abstract— In a country like Bangladesh where electricity shortage is a great problem, Rural Electrification Board is one of the few agencies that are a part of the solution. Since it is established by the government, it is provided with a lot of facilities. And, since the establishment, it has come a long way towards trying to provide electricity to as many houses in rural Bangladesh as possible. However, the problem of electricity crisis in Bangladesh is far from being solved, as the supply is still significantly lesser than the consumer needs. And, it's constantly increasing day by day. Even with the help of other agencies like BPDB, PGCB and DESCO, we are still far from solving this problem. Although new power plants have been proposed and in some cases construction has began in the last few years, another more logical approach would be look into current systems and see where the shortage occurs and how the efficiency can be improved. With that in mind, we are proposing to do detailed research study on a few particular operating rural electric cooperatives called Palli Bidyuit Samity (PBS) for REB and find out how much shortage is due to natural reasons and how much is due to human reasons which will lead us to proposing a few solution to these problems.

Index Terms— REB, Generation, Distribution, PBS, Transmission Loss, Grid Meter, one line diagram, system loss etc

1 ACRONYM

REB: Rural Electrification Board
BPDB: Bangladesh Power Development Board
PGCB : Power Grid Company of Bangladesh
DESCO : Dhaka Electric Supply Company
PBS: Palli Bidyuit Samity
RE: Rural Electrification
GSML: Grid Meter System Loss
SSL: Substation Loss
DSL: Differential System Loss

2 INTRODUCTION

Bangladesh is a country that has just recently joined the vast world of energy production, usage and re-usage. Although the country has only started its journey as early as 40 odd years ago, it has taken leaps of strides in various areas. One of which is the energy condition, more specifically the condition of electricity. Over the period of time a lot of Agencies have been formed and many other initiatives have been taken to overcome the deficiencies in the production of electricity. REB is such a type of agency that has made a huge impact in the progress of electricity condition in Bangladesh. Unfortunately there is still a huge difference when it comes to demand and productivity of electricity in Bangladesh. Even with significant steps that have been taken with the establishment of multiple power plants, there is still a huge gap that we need to overcome. To no one's surprise, renewable sources are being looked as the obvious solution to the electricity crisis. With proper management the renewable sources can be used to solve this serious problem we are facing. But, among all this one thing that is getting lost is the fact that the data we gather for the systems and their losses aren't calculated with considering all the surrounding factors. That has been the main focus while preparing this paper. The main focus of the paper has been to gather data of different system losses different PBS

zones of REB and perform a thorough research on this data to find out more details about the different kinds of losses to make appropriate assumptions about the reasons behind them. Later we have made a few suggestions for future works and improvements.

2 SYSTEM LOSS

System loss is defined by the losses in a power system starting from generating end to the consumer end. There may be different kinds of system loss like Grid Meter System Loss, Substation Loss i.e. transmission loss etc. The total of all energy lost or wasted on a system due to line loss and other forms of energy loss, unaccounted energy use and theft among other factors is referred to as system loss [1].

3 RESEARCH METHODOLOGY

In this research paper, the data of the losses in some specific feeders have been collected for two consecutive years (a specific month) and the lost electricity in terms of system loss has been determined approximately by subtracting the Substation Loss from Grid Meter System Loss. A proper explanation of the lost electricity have been discussed here and in the future work how the amount of electricity that are stolen creates demand - generation - supply gap in terms of load shedding can be recover have been discussed.

4 HISTORY OF REB

The 1970s were a time of social upliftment in Bangladesh when the government took some significant initiatives to improve the electricity condition in Bangladesh. Thus the government came up with a different approach and considered undertaking a comprehensive scheme which was creating the

Rural Electrification Board (REB) [2]. REB, a semi-autonomous government agency was established by The Bangladesh Rural Electrification (RE) program which was founded with a Presidential Ordinance in October 1977. REB reported to the Ministry of Power Energy and Minerals Resources which was responsible for electrifying rural Bangladesh. From the beginning REB has worked with a view of using electricity as a means of creating opportunities that would improve agricultural production and enhance socio-economic developments in rural areas. All of this will result in better standard of living for the rural people as well as the quality of their lives. [3]

It's been 34 years since The Rural Electrification Board of Bangladesh has been providing service to rural member consumers. And, with proper support from the Government of Bangladesh, consulting partners, the donor community and member consumers, this program has the scope to expand. This in turn will provide the gift of electricity to millions more Bangladeshi households, businesses, and industries. [4]

70 The operating rural electric cooperatives are called Palli Bidyuit Samity (PBS). At present REB has 70 PBS all over the country. This in total brings service to approximately 92, 80,785 new connection that is being made. Also more than 2, 38,711kms of line has been constructed. [5]

5 ONE LINE DIAGRAM OF POWER FLOW

A one-line diagram or single-line diagram is a simplified notation for representing a three-phase power system. The one-line diagram has its largest application in power flow studies. Electrical elements such as circuit breakers, transformers, capacitors, bus bars, and conductors are shown by standardized schematic symbols [6].

6 SYSTEM DATA FOR THE YEAR OF JUNE 2012

This is the System Data collected over the year of June 2012. Here some specific system loss data has been shown as sample and the calculation of Differential System Loss (DSL) has been calculated.

Table 1: System Data (Percentage System Loss), June 2012

PBS NAME	GRID METER SYSTEM LOSS (TOTAL) (GMSL) (%)	SUBSTATION SYSTEM LOSS (SSL) (%)	DIFFERENTIAL SYSTEM LOSS [(DSL) = (GMSL-SSL)](%)
Dhaka -1	16.50	9.34	7.16
Tangail -1	10.85	8.66	2.19
Comilla -1	15.60	13.07	2.53
Chandpur-1	11.48	4.82	6.66
Hobigonj	9.19	6.09	3.10
Moulvibazar	3.57	1.10	2.47

Pabna -1	20.69	16.09	4.60
Pabna -2	21.60	18.47	3.13
Sirajgonj	12.10	10.78	1.32
Jessore -1	17.21	14.21	3.00

A bar diagram of the system data tabulated above has been shown in the picture below where GSML, SSL & DSL have been indicated with different color.

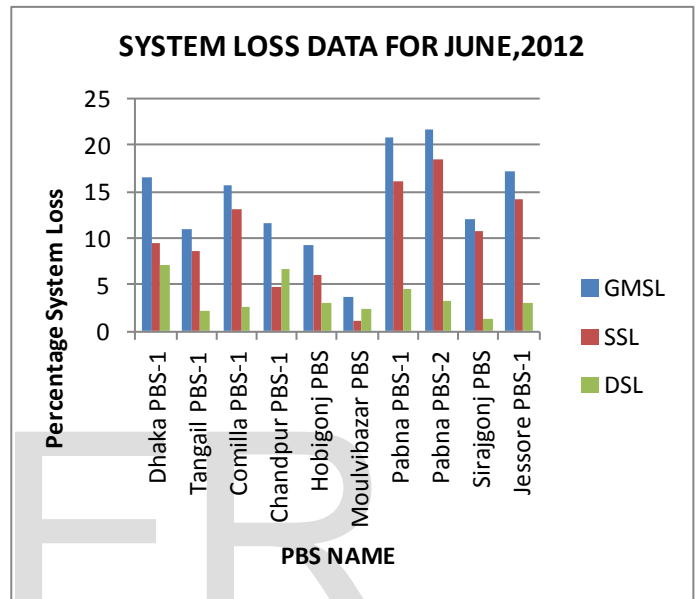


Figure 01: Bar Diagram of System Loss Data for June 2012

7 SYSTEM DATA FOR THE YEAR OF JUNE 2013

This is the System Data collected over the year of June 2013. Here some specific system loss data has been shown as sample and the calculation of Differential System Loss (DSL) has been calculated.

Table 2: System Data (Percentage System Loss), June 2013

PBS NAME	GRID METER SYSTEM LOSS (TOTAL) (GMSL)(%)	SUBSTATION SYSTEM LOSS (TRANSMISSION) (SSL)(%)	DIFFERENTIAL SYSTEM LOSS [(DSL) = (GMSL-SSL)](%)
Dhaka -1	13.97	7.78	6.19
Tangail -1	17.80	16.38	1.42
Comilla-1	13.88	12.26	1.62
Chandpur-1	23.84	19.77	4.07
Hobigonj	26.86	19.03	7.83
Moulvibazar	13.82	9.59	4.23
Pabna-1	10.44	7.20	3.24

Pabna -2	14.41	9.07	5.34
Sirajgonj	12.14	10.97	1.17
Jessore-1	14.74	11.95	2.79

A bar diagram of the system data tabulated above has been shown in the picture below where GSML, SSL & DSL have been indicated with different color.

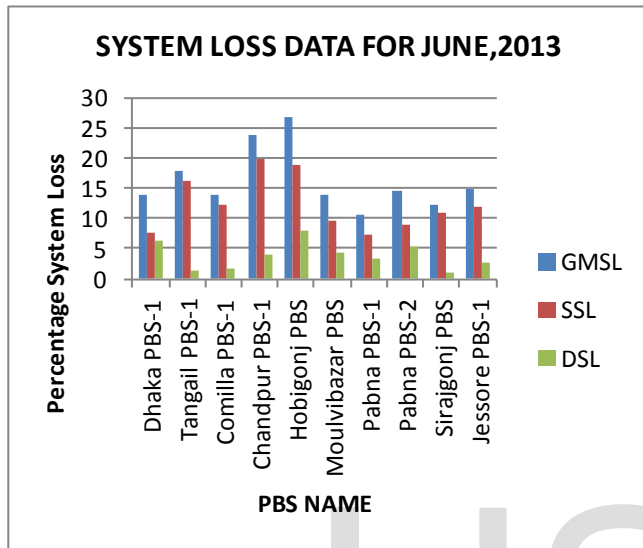


Figure 02: Bar Diagram of System Loss Data for June 2013

8 CALCULATION

Here simple subtraction method has been used to calculate the system loss data of Differential System Loss (DSL).

From the Table 1, for Dhaka PBS -1 the System Loss Data,
Grid Meter System Loss (GMSL) = 16.50 %
Substation Loss (SSL) = 9.34%

Here,

$$\Rightarrow \text{Differential System Loss} = \text{Grid Meter System Loss} - \text{Substation Loss}$$

$$\Rightarrow \text{DSL} = \text{GMSL} - \text{SSL}$$

$$\Rightarrow \text{DSL} = 16.50\% - 9.34\% = 7.16\%$$

Similarly for Tangail PBS-1 from Table 2,

GMSL = 17.80%

SSL = 16.38%

$$\Rightarrow \text{DSL} = 17.80\% - 16.38\% = 1.42\%$$

9 DIFFERENTIAL ANALYSIS OF SYSTEM LOSS DATA

The Grid Meter System Loss should be one and only the Substation Loss i.e. Transmission Loss in any power system. But practically there is a difference between Grid Meter System Loss and Substation Loss. The main objective of this research paper is to identify this differential loss and giving a proper explanation of this differential loss. Basically the major portion of the power system loss is covered by the transmission loss. But even after that transmission loss there is another loss which is termed here as

Differential System Loss. There are mainly two factors responsible for this differential loss. They are:

- ✓ Human Factors &
- ✓ Natural Factors.

The Human Factors are:

- Accidental Faults: Accidental faults can be responsible for differential system loss. This kind of fault can occur by humans due to mismanagement and misuse of different kinds of electrical appliances. These led a power system to cause accidental faults and system loss.
- Stolen Electricity: Stolen electricity is that kind of factor which is caused by the consumers when moral conviction degrades. Dishonesty is mainly responsible for this stolen electricity. Mainly consumers electrify their household even sometimes industries by taking electrical connection illegally from the power line without the concern of REB i.e. authority. This section holds a major part of differential system loss.
- Lack of proper maintenance: Lack of proper upgrading and servicing of electrical appliances and equipments cause some system loss.

Natural Factors are:

- Serge Voltage: Serge voltage is a natural phenomenon caused by thunders. This causes the electrical appliances damaged sometimes.
- Natural Disaster: Flood, Storms, Earthquake, Cyclones etc natural calamities are also responsible for system loss.

There are also some other factors responsible for differential system loss.

10 FUTURE WORKS

There are huge opportunities to continue the work in various aspects. One of the targeted extensions of this research work is to recover the losses by supplying electricity/ power from distributed generation i.e. alternative energy sources, so that the lost electricity can be recovered. There can be another extension of this work such as the load flow analysis of this work taking data of the grid system.

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