Global Journal of Enterprise Information System

DOI: 10.18311/gjeis/2018/19938

Transmission and Distribution Losses and Aggregate Technical and Commercial Losses

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Abstract

This paper presents a simple method to calculate the AT&C losses in residential area. Today most of distribution companies are suffering from high T&D (Transmission and Distribution) losses and AT&C (Aggregate Technical and Commercial) losses. Most of the companies have very high level of AT&C losses. T&D loss gives an approximate value of losses. But AT&C loss gives the accurate data of losses. In this paper we have collected the data from Housing Board Colony Jind (urban area) and calculated the level of losses in that particular Distribution Transformer wise and then suggest loss reduction methods.

Keywords: AT&C Losses, Distr ibution System, DT (Distribution Transformer), Housing Board Colony Jind, Losses, Meter

Paper Code (DOI): 19938**; Originality Test Ratio:** 14%**; Submission Online:** 02-May-2018**; Manuscript Accepted:** 11-May-2018**; Originality Check:** 13-May-2018**; Peer Reviewers Comment:** 25-May-2018**; Double Blind Reviewers Comment:** 26-May-2018**; Author Revert:** 28-May-2018**; Camera-Ready-Copy:** 29-May-2018**; Editorial Board Excerpt:** 30-May-2018.

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1. Introduction

In India national level of T&D loss is about 32.5%. Most of the distribution companies have their loss level above average rate. Power losses in the distribution system are of two types, technical and commercial. Technical losses have a small portion in total losses, main part of the losses are due to non-technical reasons. Combined both losses are called Aggregate Technical and Commercial (AT&C) losses. AT&C losses give an overall actual energy loss at the consumer end. The technical losses are due to energy dissipated in the conductors and equipment used for distribution of power[1]. Commercial losses have different reasons like theft, non billing, wrong billing, non-payment etc.

Transmission and Distribution losses are the total losses which happen between the generation and consumption. Distribution Sector considered as the weakest link in the entire power sector. Transmission Losses is approximate 17% while Distribution Losses is approximate 50%.

2. Losses in Electricity Supply

Basically there are two types of losses in distribution system. Reasons for these losses are different. Major reasons are given in brief.

2.1 Reasons for High Technical Losses[4]

- After the independence of India our major concern was on generation side not on transmission side. Very low amount was invested to improve distribution system, so losses in this section are very high.

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- Long LT 11 KV feeder produced losses.
- Old and faulty equipments.
- Under size conductors.
- Improper maintain ace and operation.
- Under size transformer.
- Faulty meters.
- Unbalanced loading of DTs etc.

2.2 Reasons for Commercial Losses[4]

- Temping of meters.
- Power theft.
- Wrong metering and billing by utility.
- By passing the meter.
- Changing CT (Current Transformer) ratio of meter.
- Poor vigilance and poor management by utility etc.

3. Calculation of T&D and AT&C Losses

T&D losses are the difference between total units billed by DT meter and total units consumed by consumers. We use the following formula to calculate the loss %:

$$\text{T\&D Loss} = \text{DT METER ENERGY} - \text{TOTAL CONSUMPTION BY CONSUMER (Ei} - \text{Ec)}$$

$$\text{T\&D Loss \%} = (\text{Ei} - \text{Ec}) * 100/\text{Ei} \quad (1)^5$$

- Ei = DT METER ENERGY.
- Ec = TOTAL CONSUMPTION BY CONSUMER.

3.1 AT&C Loss Calculations

It is the difference between energy input units into the system and the units for which the payment is collected. T&D Loss cannot realize losses due to non-realization of payments. ATC Loss provides accurate level of technical and commercial losses.

$$\text{AT\&C Loss (\%)} = \frac{\textit{Energy Input} - \textit{Energy Realized}}{\textit{Energy Input}} \times 100 \quad (2)^5$$

$$\text{Energy Realized} = \text{Energy Billed} \times \text{Collection Efficiency}$$

$$\text{Collection Efficiency (\%)} = \frac{\textit{Amount Realized}}{\textit{Amount Billed}} \times 100$$

3.2 Type of Meters Used

Following are the main meter used in different application

- **DT Meters**
  DT meter are connected on the low voltage side of the transformer to measure and record the total energy consumed by the no. of. DT meter can record energy consumed, give information of power factor, load, peak value of voltage, current, total time record's, duration of maximum loading and peak load values etc[5].
- **CMRI**
  CMRI is known as Common meter reading instrument (CMRI). It is compact, portable and small in size. It is used to download the data of DT meter, poly-phase meters, CT meters etc. It is an external port peripherals device[5].
- **Consumers Energy Meter**
  By the use of energy meter we record the energy consumption of the consumer for the specified time. There are different types of energy meter used for the different type of consumers with accuracy, for example different consumers like domestic, Commercial and industrial. Mainly we use the following meters as the type of consumer[5].
  - Single phase meters.
  - 3 phase 3 wire meter.
  - 3 phase 4 wire meters.
  - 3 phase 4 wires CT connected meter.

4. Methodology

In this work methodology adopted is shown below in the form of block cycle diagram:

Figure 1. Methodology diagram.

Methodology of calculation of %TD loss and %AT&C Loss

1. Note DT meter energy by the use of CMRI.
2. Consumer tagging.
3. Consumer data collection.
4. Calculate T&D loss % and AT&C loss %.
5. Generate report on losses %.
6. Apply loss reduction methods.

To find the T&D loss % based on DT for particular category of consumers, we have chosen an urban area of jind, Haryana. This area has all types of consumers. We took 6 (11/0.4 KV) Distribution Transformer of Housing Board Colony Jind

The details of DT are as:

1. Housing Board NH & SS group 1, (DT capacity-500 KVA)
2. Housing Board NH & SS group 2, (DT 1 capacity-200 KVA)
3. Housing Board NH & SS group 3, (DT 2 capacity-200 KVA)
4. Housing Board NH & SS group 4, (DT 3 capacity-200 KVA)
5. Housing Board NH & SS group 5, (DT 4 capacity-200 KVA)
6. Housing Board NH & SS group 6, (DT 1 capacity-200 KVA)

First of all take the DT meter reading by the use of CMRI OR directly this is the input energy (Ei), and the consumed energy (Ec) is consumed by consumer.

We find the T&D loss % and AT&C loss % by using the formula (1) and (2) respectively for the months July, August, September, October, November and December.

Now find the causes of loss for area which help to reduce the losses specified area

Table 1. Housing board NH & SS group 1, (DT capacity-500 KVA)

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
TOTAL CONSUMPTION	71755	74470	53843	53981	36678	35495
DT meter energy	86539	90600	64026	63517	43571	42923
%AT&C LOSS	27.09	27.68	26.26	25.11	30.54	26.34

Table 2. Housing board NH & SS group 2, (DT 1 capacity-200 KVA)

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
TOTAL CONSUMPTION	47498	49040	20119	35288	26182	26067
DT meter energy	60317	61767	25236	43622	32485	32817
%AT&C LOSS	34.06	33.50	40.19	30.26	31.12	33.79

Table 3. Housing board NH & SS group 3, (DT 2 capacity-200 KVA)

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
TOTAL CONSUMPTION	46395	47942	34970	35896	31574	25485
DT meter energy	56292	58431	43165	43704	37863	31598
%AT&C LOSS	30	31	30	28	26	30

Table 4. Housing Board NH & SS group 4, (DT 3 capacity-200 KVA)

	JUL	AUG	SEPT	OCT	NOV	DEC
TOTAL CONSUMPTION	975	1007	657	635	263	255
DT meter energy	1148	1213	770	737	306	302
%AT&C LOSS	34.93	36.36	30.96	30.20	15.80	17.44

Table 5. Housing board NH & SS group 5, (DT 4 capacity-200 KVA)

	JUL	AUG	SEPT	OCT	NOV	DEC
TOTAL CONSUMPTION	21192	22218	16094	15734	11392	10997
DT meter energy	25854	26661	19152	18724	13942	13597
%T&D LOSS	26.70	25.35	24.32	24.23	38.81	39.48

Table 6. Housing Board NH & SS group 6, (DT 4 capacity-100 KVA)

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
TOTAL CONSUMPTION	2564	2649	1866	1805	959	928
DT meter energy	3021	3070	2176	2120	1102	1108
%T&D LOSS	36.23	35.16	32.76	33.21	30.78	33.46

5. Result and Discussion

From the data we find out the Transmission and Distribution losses. We have one 500 kva transformer, four no's 200 kva transformer and one 100 kva transformer in the housing board colony Jind. These different transformers have different AT&C loss depend upon the consumer. We calculated the losses. In the 500 kva AT&C losses are nearly 27.07%. In the 200 kva 1 AT&C losses are nearly 33.22%. In the 200 kva 2 AT&C losses are nearly 2929%. In the 200 kva 3 AT&C losses are nearly 31.37%. In the 200 kva 4 AT&C losses are nearly 28.52%.In the 100 kva AT&C losses are nearly 34.15%. The losses can be reduce by different method.

The graph can be draw of for the %AT&C loss as per Distribution transformer.

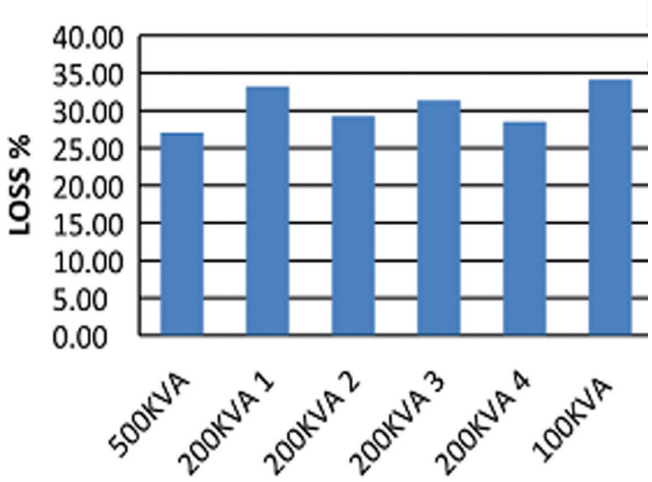

Figure 2. Average AT&C LOSS % of 6 DT's.

6. Conclusions and Future Directions

From the collected data and applying formula we have estimated the losses of power in the distributed area of housing board colony Jind. The AT&C losses in the month of July is 29.79% in August 29.77% in September is 29.94% in October is 27.64 in November is 30.08% and in December is 30.40%. By apply the loss reduction method we can reduce losses in the future and save the energy. We can also find the Transmission and Distribution Loss. These losses should be low if these losses increase that's direct indicate wastage of power and money and efficiency will decrease. So to reduce these losses we have discuss different method .Main reason of these loss is theft of power. We prevent the theft of power in the future. There are also different method for the specified area we can apply by finding the losses. For reducing losses we can apply Arial bunch cable, pre-paid meter. Separating domestic, commercial and industrial feeder we can reduce the loss.

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5. Pawar R, Singh J. Calculation of T&D Loss % based on 11/0.4 KV substation in a distribution utility. 2012 IEEE 5th Power India Conference2012 Dec19-22.

Annexure-I

Transmission & Distribution losses and Aggregate Technical & Commercial losses

ORIGINALITY REPORT

14%

SIMILARITY INDEX

PRIMARY SOURCES

1	Rajneesh Pawar, Jitender Singh. "Calculation of T&D Loss % Based on 11/0.4 KV Substation in a distribution utility", 2012 IEEE Fifth Power India Conference, 2012 Crossref	120 words — 8%
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Citation:
Saket Gaurav, Sunita Pal, Swati Jain and Rahul Katna
"Transmission and Distribution losses and Aggregate Technical and Commercial losses",
Global Journal of Enterprise Information System. Volume-10, Issue-1, January-March, 2018. (http://informaticsjournals.com/index.php/gjeis)
DOI: 10.18311/gjeis/2018/19938
Conflict of Interest:
Author of a Paper had no conflict neither financially nor academically.