

AGGREGATE TECHNICAL AND COMMERCIAL LOSS ANALYSIS IN THE AREAS OF KAMRUP DISTRICT UNDER GEC-II, ASSAM: A CASE STUDY

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Abstract :The power distribution system being the last stage in power delivery system is considered to be the largest part in power system. Electricity becomes the utmost need now-a- days with the increasing population and economic development. Loss in electrical power can act as a barrier in the economic development of a country. Technical and commercial loss being the major part of loss in power sector needs to be eliminated to the optimal level to improve the system efficiency. In this paper, factors causing AT&C losses, different loss reducing measures and AT&C loss computations in different subdivisions under Guwahati Electrical Circle-II (GEC-II) are discussed. The study would certainly help in bringing forth the desired improvement in power distribution, having known the leaking points and theft, and if measures are taken to arrest those losses significant positive changes can be brought in power sector.

IndexTerms–Distribution loss, technical loss, commercial loss, AT&C loss, collection efficiency, billing efficiency, loss reduction measures, GEC-II

I. INTRODUCTION

Power systems is becoming complex with time and is one of the crucial inputs to the overall economic growth of a country. With the increasing population and economic development, India's power requirement is increasing at a relatively fast rate. In the recent years, India's energy consumption has been increasing at one of the fastest rates in the world due to population growth and economic development even though the base rate may be somewhat low. India ranks fifth in the world in terms of primary energy consumption, accounting for about 3.5% of the world commercial energy demand. Despite the overall increase in energy demand, per capita energy consumption, India is still very low compared to other developing countries.[1-2] Nevertheless, energy poverty is still an issue in country like India which is facing electricity deficits. Series of reforms have been going on this sector for several decades focusing mainly on the generation side and as a result India's power deficit dropped to a historical low of less than 1% last fiscal.[5] Still there is a large gap between the demand and supply. So transmission and distribution losses is still remains a concern. Maximum part of the energy that has been generated is lost in transmission and distribution phases and India has one of the highest Transmission and Distribution (T&D) losses among the world.[3] which is shown in figure 1[4]. Earlier, this loss is known as a whole T&D loss. But the Distribution Loss is relatively very high compared to Transmission Loss and they cannot be treated equally as distribution loss is increasing in a rapid way contributing the major part of loss in power system. So Aggregate Technical and commercial losses (AT&C) came in to picture and it is high time to implement different programs and take actions to reform the distribution sector as it can be considered as the weakest link in power sector in India to bring about the financial viability. Electric power transmission and distribution losses (%) as a proportion of electricity output.[4] in India among the world is shown in figure-1.

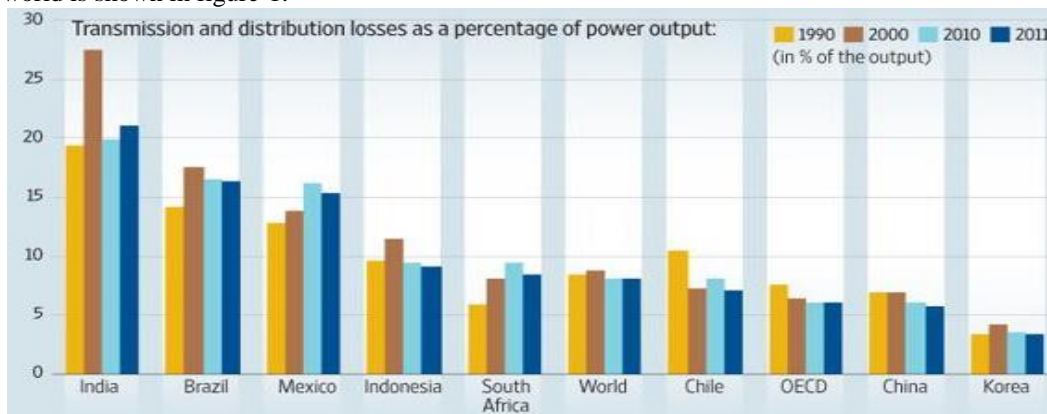


Fig 1: Transmission and Distribution Losses as a Proportion of Electricity Output of India

II. DIFFERENT LOSSES IN POWER SYSTEM

2.1 Technical Loss

The technical losses are cumulative energy consumed in transmission lines, power transformer and various equipments and measuring instruments used in transmission sector.

Factors contributing Technical Losses-

The following are the major reasons for high technical losses in our country.

- Copper losses in conductor
- Dielectric losses in the dielectric material used in conductor
- Lengthy Distribution lines
- Improper Sizing and selection of equipment/component used
- Low Power Factor of Primary and secondary distribution system
- Bad Workmanship
- Unbalanced loading
- Switching off transformers
- Less investment on infrastructure improvement for transmission and distribution sector
- Short-term objective of extension of power supply to new areas
- Over loading of lines/transformer
- Abnormal working operating conditions
- Poor quality of equipment used

2.2 Commercial Loss

The gap between the actual amount of energy delivered to consumer and the energy measured by the meters as the consumed energy in the consumer side i.e. the actual energy delivered to the consumers but not billed. The commercial losses is also termed as non-technical losses which is difficult to calculate in compared to the other losses which is normally expressed in terms of injected units in percentage and calculated for a period of one financial year.[7]

$$\text{Hence, T \& D losses (\%)} = \frac{(\text{Energy input} - \text{Energy billed}) \times 100}{\text{Energy input}} \quad (\text{For a financial year})$$

Factors contributing commercial Losses-

The following are some of the factors that cause commercial losses in our country-

- Meter tempering
- Software errors in technical loss computation
- Meter reading and recording error
- Stealing by making illegal connection
- Ignorance of unpaid bills
- Low accountability and false reading by employees
- Inadequate Energy Audit
- Prolonged disputes
- Non-payment of billed amount
- Fault in testing and calibration of meters

2.3 Aggregate Technical and Commercial (AT&C) Loss

There is one more loss in revenue due to non-realization of billed demand in addition to commercial losses and the aggregate of T&D and revenue loss is termed as AT&C loss. Therefore AT&C loss to the utility is the sum total of technical loss, commercial losses and shortage due to non-realization of total billed demand.[9] High AT&C losses are due to high T&D losses coupled with low collection efficiency. AT & C loss is a transparent measure of the overall efficiency of the distribution business as it measures technical as well as commercial losses.[6]

$$\text{Collection efficiency (\%)} = \frac{\text{Amount Realized} \times 100}{\text{Amount billed}}$$

$$\text{Energy realized} = (\text{Energy billed} \times \text{Collection efficiency})$$

$$\text{AT \& C loss (\%)} = \frac{(\text{Energy input} - \text{Energy realized}) \times 100}{\text{Energy input}}$$

Factors contributing AT & C Losses:

There are some other factors contributing AT&C losses in addition to the factors for technical and commercial losses are

- Due to poor accountability of the employees which results in low collection efficiency
- Inadequate collection facilities
- Less or limited use of advanced technology
- Consumer unawareness of recent technology used in payment
- billing errors
- political/administrative interference

III. SCOPE OF LOSS REDUCTION

3.1 Technical Loss Reduction

Short term measures: Some of the short term loss reduction measures are given below:

- Network reconfiguration
- Load balancing
- By insulators leakage prevention
- Better management of Distribution transformers

- Taking measure to improve the joints and connections
- By adopting preventive maintenance of distribution network regularly

Long term measures: Long term measures indicate the actions and planning adopted to improve the transmission and distribution system by using advance techniques which will lead to improve the quality and reliability of the system and reduce the energy gap between generation and distribution to meet the future demand. Long term measures can be-

- Proper Existing system Analysis
- Proper plan to upgrade and improve the existing network
- Starting from grid sub-station up to consumers level, data collection of the performance of the system at different working condition and proper analysis of the collected data
- Existing system mapping
- Load forecast
- Analysis to evaluate least cost optimal solution
- Financial analysis

3.2 Commercial Loss Reduction

The measures for reducing commercial losses are-

Preventive measures:

- Testing of check points before installing meter
- Use of electronic meters with tamper and having logging features of load survey
- Use of optical port for taking the reading
- By proper sealing of meters and CTs/Pts to avoid tampering/bypassing
- Seating of meters with seals and having proper seal management system
- Testing of meters and software before installing to avoid faulty reading

Planned measures:

- Aerial Bunched Cables
- By adopting facilities like Spot Billing, electronic cash register, Drop box, Collection agencies etc.
- Energy auditing
- Like any other theft, electricity theft should be taken seriously and strict punishment should be there.

IV. GRAPHICAL INTERPRETATION OF BILLING, COLLECTED EFFICIENCY AND AT&C LOSSES OF AREAS UNDER GUWAHATI ELECTRICAL CIRCLE –II (GEC-II)

The ultimate objective of the Company, Assam Power Distribution Company Ltd. (APDCL) is to undertake the electricity distribution, trading, supply in the state of Assam or outside in accordance with provisions of Applicable Law and all activities in well synchronized manner.[10] The electricity trading and revenue function of Kamrup district is categorized in two electrical circles. They are- Guwahati Electrical Circle-I and Guwahati Electrical Circle-II.

For the fulfillment of the computation of AT&C losses in some parts of Guwahati, Assam, the following data are collected from Guwahati Electrical Circle-II, Maligaon under APDCL. The GEC-II holds the following eight electrical subdivisions (ESD) under its surveillance-

- Jalukbari Electrical Subdivision
- Amingaon Electrical Subdivision
- Sualkuchi Electrical Subdivision
- Hajo Electrical Subdivision
- Mirza Electrical Subdivision
- Chaygaon Electrical Subdivision
- Boko Electrical Subdivision
- Azara Electrical Subdivision

From the collected data, the bar diagram of Bill efficiency, Collected efficiency and AT&C losses for the years (2010-2013) for Amingaon ESD, Mirza ESD, Sualkuchi ESD and GEC-II are presented in Figure 2-5 respectively.

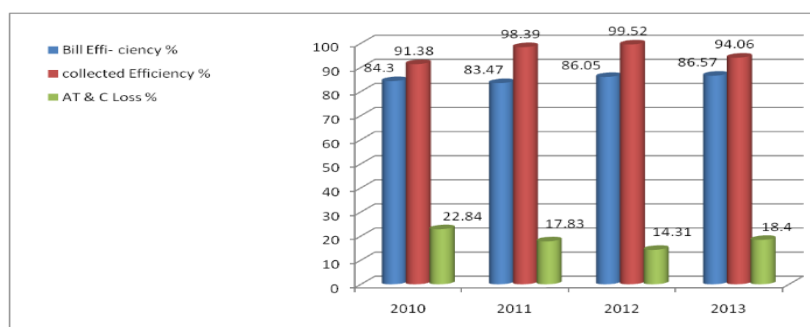


Fig.2: Bar diagram showing Average Bill Efficiency, Collected Efficiency and AT&C losses for the years (2010-2013) of Amingaon ESD

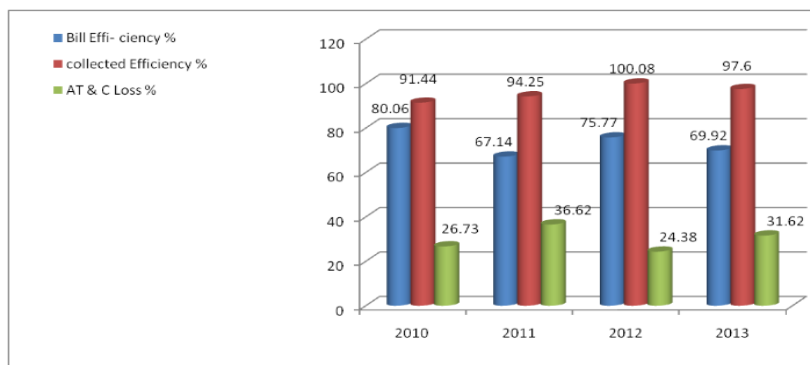


Fig.3: Bar diagram showing Average Bill Efficiency, Collected Efficiency and AT&C losses for the years (2010-2013) of Mirza ESD

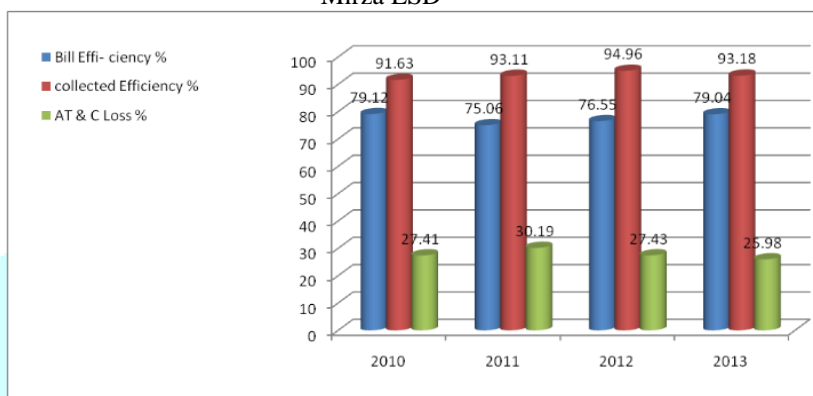


Fig.4: Bar diagram showing Average Bill Efficiency, Collected Efficiency and AT&C losses for the years (2010-2013) of Sualkuchi ESD

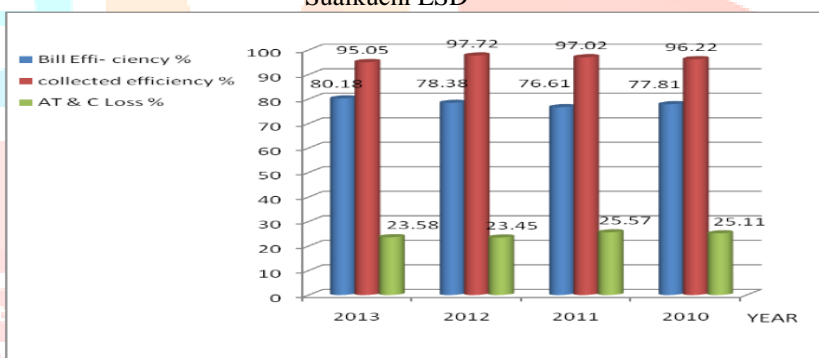


Fig.5 Bar diagram showing Average Bill Efficiency, Collected Efficiency and AT&C losses for the years (2010-2013) of GEC-II

V. MEASURES TAKEN BY APDCL TO REDUCE TECHNICAL AND COMMERCIAL LOSS

Some of the key measures extensively adopted by APDCL[8] are-

- Infrastructure development through R-APDRP, Chief Minister's Power Supply Assurance Mission, Assam Bikash Yojana, ADB financed schemes etc.
- Replacement of stopped and defective meters regularly
- Installation of checked meters in industrial houses & high power consuming customers
- Massive disconnection drive
- Use of computerized systems for metering & billing
- Infrastructure development through R-APDRP, Chief Minister's Power Supply Assurance Mission, Assam Bikash Yojana, ADB financed schemes etc.
- Creation of 12 special police stations ? Creation of 24-hour 'Central Electricity Theft Control Centre' at Guwahati (Dial 96780-05171)
- Handing over of rural distribution feeders to franchisees for improved collection and service.

VI. CONCLUSION

The distribution system being the connecting bridge between the generation and the consumer is considered as the largest part of power sector which is the key measure of performance indicator of power sector. But this is unfortunate that in India Distribution loss very large compared to the other losses which is also considered as technical and commercial losses. As these are the inherent losses in a system, complete removal is difficult but the losses occurred can be minimized to an optimal level by undertaking loss reduction magnitudes and taking actions. This paper is an intent to analyze approximately the overall AT&C loss in the area under GEC-II and some measures taken by APDCL to reduce the overall AT&C losses. This paper also gives information of different factors contributing AT&C losses and different measures to minimize the mentioned losses.

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