

Non-technical Losses in Power Distribution System

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Abstract

In this paper, we studied the scenario of distribution losses in Haryana due to electricity theft. The electricity board in the state of Haryana is facing financial losses owing to these distribution losses and the main reason for this is the non-technical losses. Distribution losses account for the mismatch between the billed electricity units and supplied units. The major factors which are responsible for distribution losses are system inefficiency, tampering with energy meter, hiding actual installed load, malpractice of electricity theft etc. Social and economic factors like literacy, income, lack of information etc. also affected the distribution losses in Haryana, a rural dominated Indian State. Haryana is an Indian State in which 65.21% of total population lives in the rural areas. In this paper, we analyse the distribution losses based on the data obtained from the distribution company in the northern areas of State (i.e., Uttar Haryana Bijli Vitran Nigam Ltd.). For indicative analysis, we have chosen Kharkhoda block of Haryana State as the sample area for study of the distribution losses based on the data provided by UHBVNL.

Keywords:

Distribution losses;
Power utilities;
Socio-economic;
Electricity theft;
Haryana.

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1. Introduction

Distribution companies play a very crucial role for the power sector, therefore, any fragile condition of the distribution companies always affects the power sector badly. Distribution losses are one of the major factors for financial crisis of the power sector [8-14]. Power sector of all the

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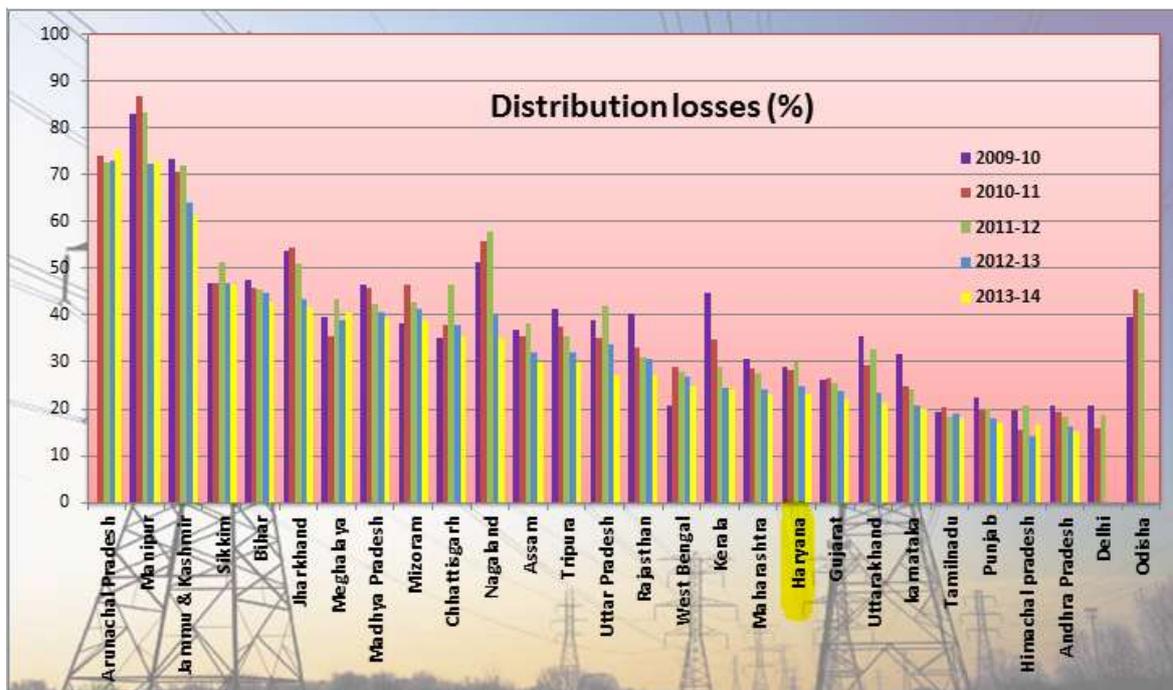


Fig. 1 State wise distribution losses in India

Source: Annual report (2013-14) on the working of state power utilities and Electricity Department, by planning commission, GOI

Countries, either developed or developing, faces the monetary losses on account of non-technical distribution losses. The condition of developing countries like India, Malaysia, Bangladesh, Nepal, Pakistan etc. in the contest of distribution losses is more fragile as compared to the developed countries like US, Europe etc. Due to the socio-economic background and geographical conditions of the State of Haryana, there are high distribution losses in the State. State wise distribution losses chart is shown in Figure 1.

Today, the utility companies all over the world are annually losing approximately \$25 billion, of which \$4.5 billion are lost by Indian utilities only [2]. Even 10% of this amount, if recovered, could conserve about 83,000 GWh of electric energy and reduce carbon dioxide emissions by 9.2 million tons annually [5]. The graveness of the distribution losses can be estimated from the fact that these losses are around 10-40% of the total generating capacity [7]. Distribution losses cost India's economy 1.5% of GDP each year, putting more burden on precarious finances of the utilities [1]. Sometimes, the amount of loss may be approximately equal to or more than the overall profit of the utilities, making them operate at zero profit or with bank credits. These losses are degrading the service quality of distribution companies [15-27]. Distribution losses are equally detrimental to the interests of consumers, as highlighted in Figure 2. Distribution loss is the loss of units that have been supplied but not billed by the utility. The electricity units lost in between the way are attributed to different practices [7]. The distribution losses have both technical and non-technical facet. The distribution losses are mainly attributed to electricity theft, which has been made a punishable offense by the Section 135, Electricity Act, 2003. Still, practice of electricity theft is publicly visible at many distribution feeders, though, after certain policies and changes in regulatory framework, there has been high decrease in the losses. For instance, in Chile and Argentina, the distribution losses got reduced by half in seven and three years respectively, due to the deregulation of the electricity sector [6].

Uttar Haryana Bijali Vitran Nigam Ltd. (UHBVN) and Dakshin Haryana Bijali Vitran Nigam Ltd. (DHBVN) are the main electricity distributors in the Haryana. UHBVN operates in the north Haryana whereas DHBVN operates in the south Haryana. Both these power companies are facing

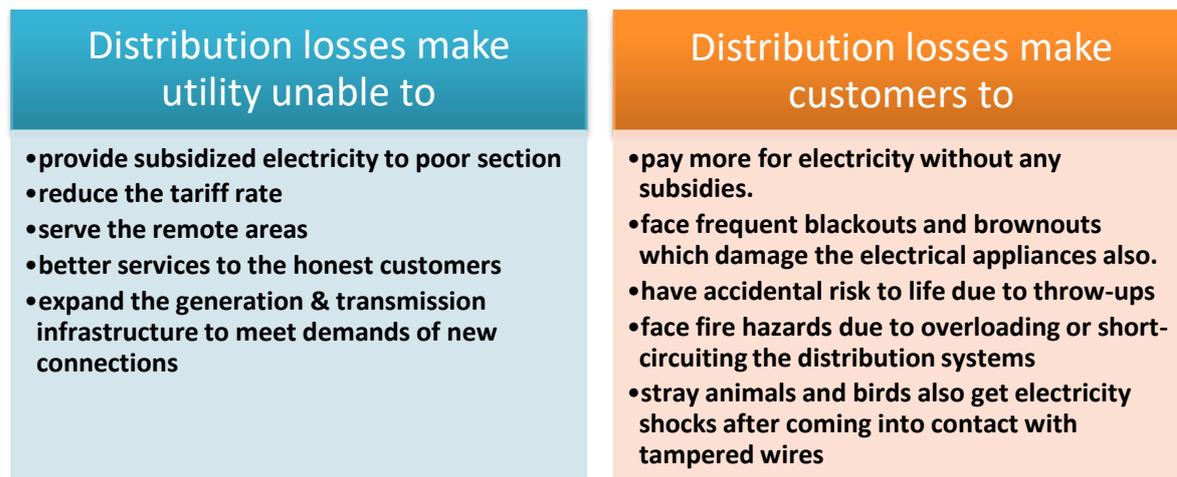


Figure 2. Effects of distribution losses on the utility and consumers

financial problems due the distribution losses as per data provided by DISCOMs. These companies in the FY 2014-15 were having total losses of Rs. 29029 Crores with huge amount of outstanding debt and high interest burden. The power sectors are working under zero profit or with bank loan i.e. total loss may be approximately equal to or more than total profit. Due to the distribution losses, the loss of the utilities companies all over the world are approximately equal to 25 billion dollar, of which 18% are lost by Indian utilities.

Distribution losses makes utility unable to provide subsidized electricity to poor section, to reduce the tariff rate, to serve the remote area, to offer better services for the honest customer, for expansion of the generating capacity and transmission infrastructure to compensate the extra load. Due to distribution losses, customer faces problem like more payment for the electricity without any subsidies, grid failure (complete blackout), have accidental risk to the life due to throw-ups, fire hazards etc. Distribution loss is defined as the loss of units for which bill is not generated by the utility. Electricity in northern areas of Haryana is supplied by the UHBVN. The utility is not able to recover the total invested money by the customers.

In this paper, we only focus on the non-technical distribution losses due to electricity theft. Here, we discussed several reasons for the distribution losses (mainly electricity theft) in Kharkhoda area of Haryana State to get the birds' eye-view of overall losses in Haryana State.

2. Literature Review

For the utilities all over the world, losses in the distribution sector became the primary concern, in which, losses due to malpractice of the electricity became main point [28-85]. Socio-economics also affect the distribution losses in the power sector. B. Min and M. Golden [3] published a report on the distribution manipulation for favouring political connection during the 2014 election. Consequently, they have found that the distribution losses is increased by 3% during the prior of election period. The result of study state that the political parties retain their local seat if more unbilled electricity is supplied to the voters in the election period. We can say that the corruptions in the society are also play a crucial role for the losses in the distribution losses. Most of the countries all over the world start thinking in the direction of zero distribution losses by updating the billing system. F. M. Mwaura [4] suggested a new method, i.e., electricity prepayment bill in the year 2012 for Uganda as a strategy for reducing the non-technical electrical losses. Prepayment bill methods are also reduced corruption in the distribution sector during the election period or in the system. F. M. Mwaura studied that the prepayment bill method in Rwanda has been favourably implemented to reduce the non-technical losses in the distribution sectors. There are several case studies based on prepayment bill (prepaid metering) or different strategy methods for reducing the non-technical losses in the distribution sector. Here, we mainly focussed on the non-technical losses in distribution sector for State of Haryana.

3. Case Study of Haryana

In this paper, we have analysed the case study of a block of Haryana, i.e., Kharkhoda for the analysis of distribution losses in the rural, urban and industrial areas during the three financial years from April 2013 to March 2016. For this analysis, secondary data was obtained from the utility operating in the area, i.e., UHBVNL. There are eight number of blocks in the sonipat district- Sonipat, Ganaur, Kharkhoda, Rai, Gohana, Kathura, Mundlana, and Murthal. According to census 2011, district has total population of 14.50 lacs. In sonipat district, female literacy rate (69.80%) is lesser than the male literacy rate (87.18%), whereas overall literacy rate in sonipat district is 89.12%. Sonipat district has less than half of the population lived in the urban areas (4.15 lacs) as compared to the rural areas (9.97 lacs). Therefore, case study of one block of Sonipat, i.e., Kharkhoda has been chosen for analysis of distribution losses. In this section, the results of study are explained and at the same time, the comprehensive discussion has also been given. Results were presented in figures, graphs, tables and others to make the reader understand easily. The discussion was divided according to type of feeder considered for analysis.

3.1. Rural feeders

In the rural areas of Kharkhoda, every feeder has very high losses. All the feeders have annual average losses of 80% (Figure 2). Being the rural area, no scheme or strategy could be implemented successfully to bring the losses down. In rural areas, customers have different attitude towards electricity theft due to their literacy level and low earnings. Those people don't consider the theft as the illegal activity rather they consider it as the way of saving their money. They think that if the utility is making the profits by highly charging from them, they can also cheat the utility rightfully. The losses on all the feeders of rural areas of Kharkhoda have increased in FY 2014-15, as shown in the Figure 2. There are no large seasonal variations in the losses. In FY 2015-16, there are drastically high losses in all the feeders (Figure 2). Even in other months, there is large number of hooking activities going on in the rural areas causing the billed units very small as compared to actual received units by the utility.

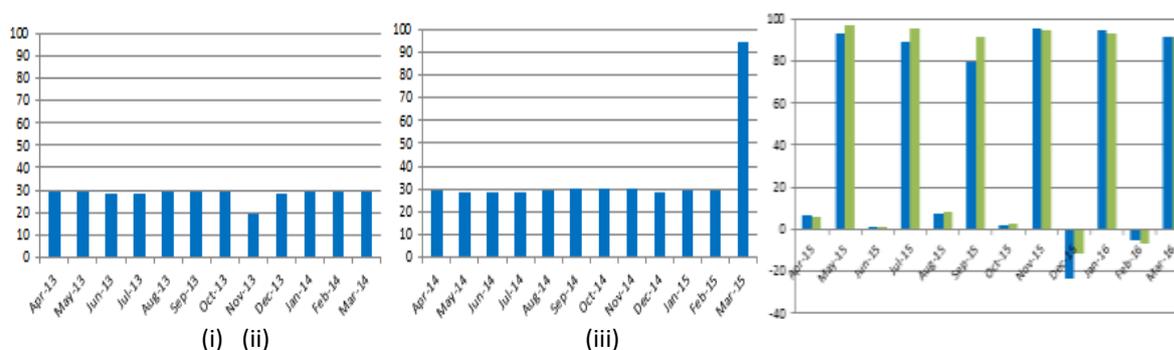


Figure 2. Distribution losses at rural feeders (in %) (i) FY 2013-14 (ii) FY 2014-15 (iii) FY 2015-16
(Blue color shows Kharkhoda DLI Rd and Kharkhoda Rohtak Road)

3.2. Industrial feeders

In the block of Kharkhoda, there are only two feeders serving the industries. The industrial feeders have very small losses throughout the FY 2013-14 (Figure 3). For the industrial feeders, utility provides two meters installed, one at the substation and other at the customer premises. Both the meters show approximately equal reading making the billed units equal to received units by the utility. Generally, the losses at the industrial feeders are in the range of $\pm 5\%$. In the month of April in 2013, due to meter reading issue, no units were billed resulting into huge amount of losses at both the feeders. In FY 2014-15, there were around 4% losses throughout the year. The cases of electricity theft are comparatively very negligible in the case of industrial customers. The negative losses at the feeder line 'Ind. Ferojpur' are due to the faulty meter and resultant average

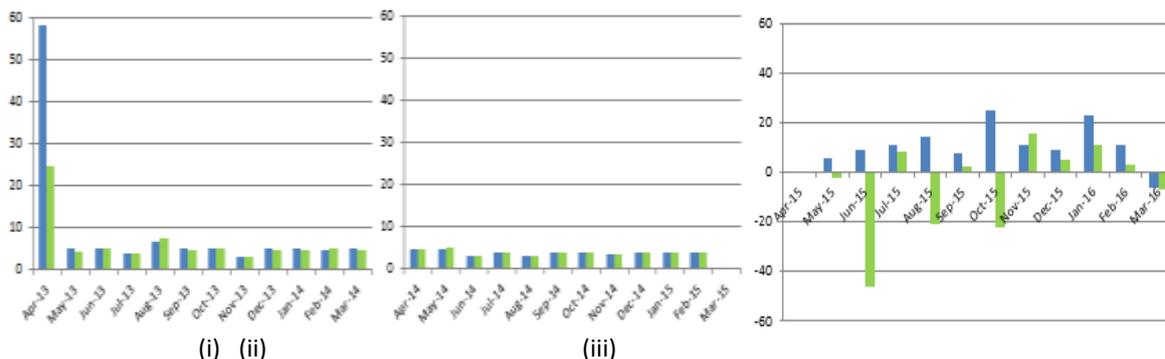


Figure 3. Distribution losses at industrial feeders (i) FY 2013-14 (ii) FY 2014-15 (iii) FY 2015-16 (Blue color shows Industrial Saidpur feeder and Green shows Industrial Ferojpur feeder)

billing. These result into negative losses, i.e., larger units billed than units received at the industrial feeders.

3.3. Urban feeders

In the urban areas of Kharkhoda, cases of electricity theft are lesser as compared to the rural areas, but still electricity theft occurs. There is only one urban feeder in Kharkhoda which has almost same losses throughout the FY 2013-14 (Figure 4). People living in urban areas illegally tap electricity for running their heavy loads like air conditioners, coolers etc. This results into billed units lesser than the received units on the feeder. In FY 2014-15 also, the losses at the urban feeder of Kharkhoda are same, i.e., approximately 30%. Due to lack of man-power, meter reading process was not done completely. This resulted into negligible units billed causing the large gap from the received units at the feeder line. Consequently, the feeder had large losses in the month of March, 2015 (Figure 4). In April 2015, the units due for billing for the month of March, 2015 were billed by the utility, resulting into small losses.

During FY 2015-16, utility had the billing process bimonthly. So, in the alternate months, the billed amount is very less as compared to the received units at the feeder. This amounted to huge loss at the feeder. Small losses in the alternate months are due to the occurrences of electricity theft and small negative losses are due to the faults in billing process.

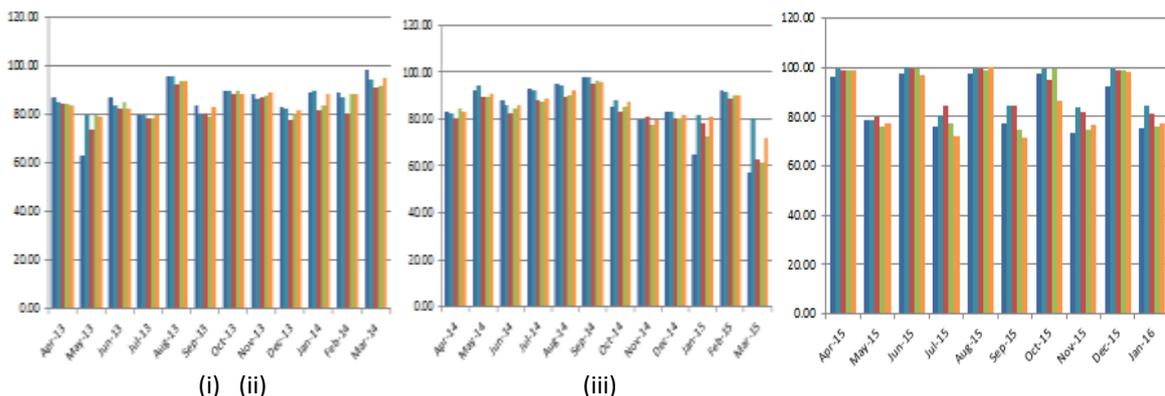


Figure 4. Distribution losses at rural feeders (i) FY 2013-14 (ii) FY 2014-15 (iii) FY 2015-16 (Blue color shows Gopalpur feeder, Light blue shows Mandora DS feeder, Red shows Ferojpur feeder, Green shows GarhiSisana feeder and Orange shows Matindu feeder)

4. Discussion

Apropos to the secondary data analysis of distribution losses in district Sonapat, it is inferred that the distribution losses in Haryana, particularly in the district Sonapat, are not engendered by one single cause. Among many causes, the major one is electricity theft followed by billing and

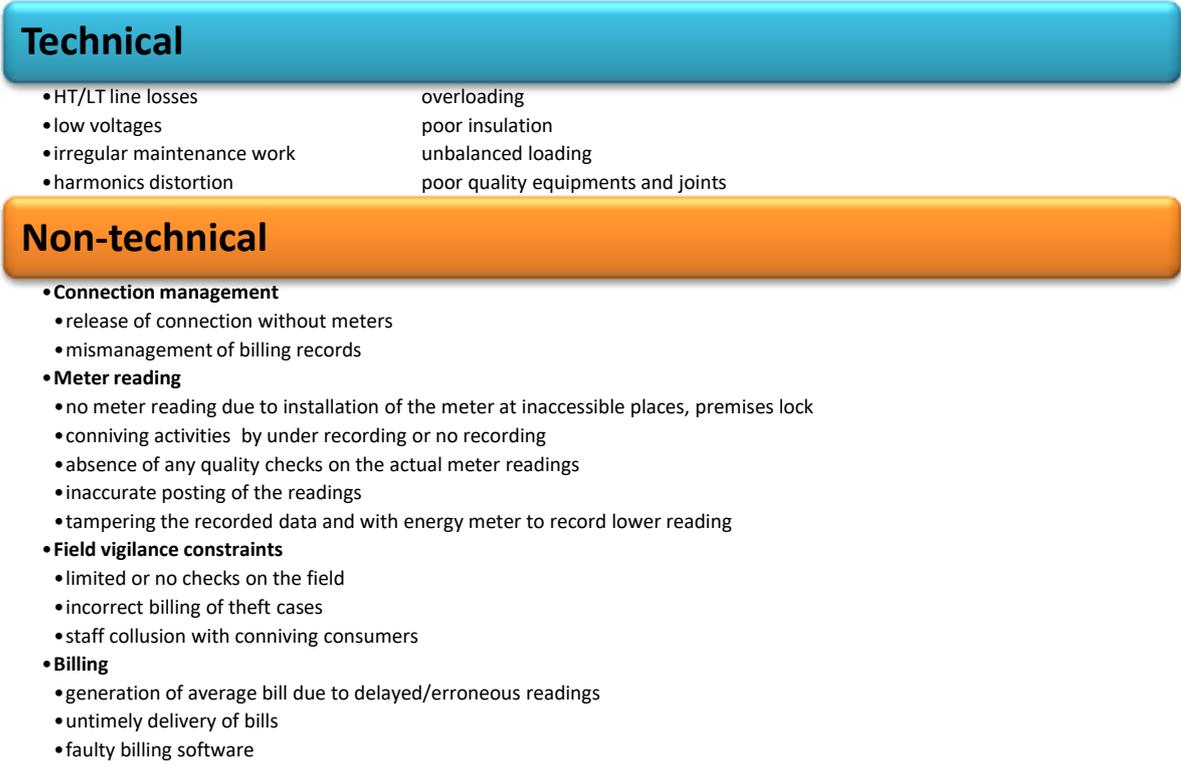


Figure 5. Factors responsible for distribution losses

metering irregularities. Overall causes of the distribution losses in the district have been listed in Figure 5. Distribution losses are not merely dependent on technological loopholes. Socio-economics also plays a very important role behind the rise/fall in distribution losses. Distribution losses in a particular area depend on various socio-economic factors, listed in Figure 6. These factors influence the customers' attitude that highly affects the level of distribution losses.

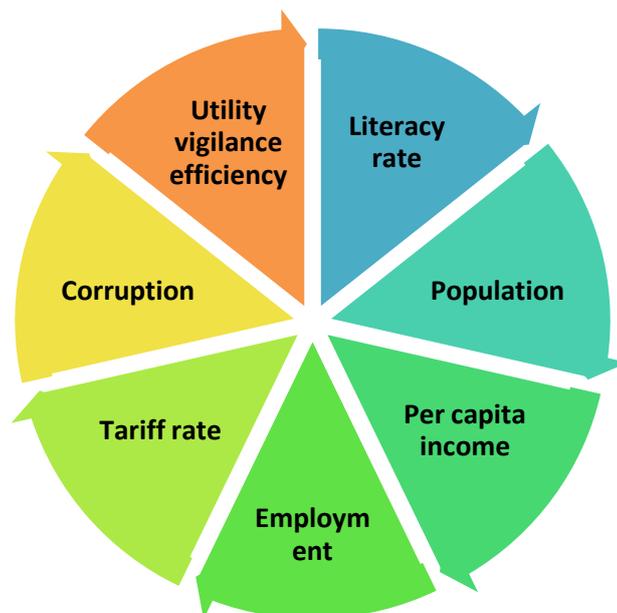


Figure 6. Socio-economical factors of distribution losses

The problem of distribution losses can't be tackled by technical measures alone. They have to be backed up by non-technical solutions also. The primary and the most frequent suggestion is to increase the frequency of sudden visits of vigilance teams at odd hours of day. Vigilance team should be reconstituted at rotation basis or should be constituted from interstate employees to prevent the collusion of consumers with dishonest employees.

All the unmetered connections should be regularized. Local groups – Panchayat/ Ex-service League should be engaged for correct metering, billing and collection management. Tariff should be revised and made affordable even to poor section of the society. Extra surcharges should be waived off in the electricity bills. Higher amount of electricity bills tempt the poor consumers to steal electricity instead of honestly paying their bills. Strict legal actions (or with imprisonment) should be taken against person found guilty in theft cases to deject other persons from doing theft. Other way is to award the honest consumers in form of any benefits or subsidy in the bill. The name of the defaulter persons should be announced publicly so that people would fear from doing theft due to social respect. Utility company should held awareness campaigns for spreading information about negative effects of electricity theft from all perspectives. To motivate the people to complaint against theft, theft informers should be secretly awarded or given incentives and FIR lodging process should be computerized.

4. Conclusion

Utilities are in dire straits owing to distribution losses in the feeder lines. These losses are progressing rapidly day-by-day despite of various administrative and regulatory policies and programmes. This work revolves around the distribution losses occurring in the State of Haryana. Having the major part as rural area, the utility operating in this area, UHBVNL is continuously facing large distribution losses. The problem has worsened much in the rural areas as compared to urban and industrial areas. This fact is corroborated by the socio-economic aspect of the distribution losses. Different feeder lines have different scenarios of distribution losses due to different socio-economic structure in that area. Therefore, the planning of mitigation strategies for the distribution losses also demands the socio-economic perspectives besides the technical advancements.

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