Distribution System Loss Reduction by Re-Constructing Distribution Network

Jitender Singh[1], Vikas[2], Joginder Singh[3] , Abhishake jain[4] , Yogesh[5] , Mandeep Kumar[6]
[1,2,3,4,5] Department Electrical Engg. , Ganga Institute of Technology and Management, Kablana, Jhajjar, Haryana, India

***Abstract*— This paper presents a novel approach to reduce the Technical loss of a rural distribution substation. Today Most of distribution utilities suffering due to high level of losses. Our main concern is about technical losses in this work. This paper shows a simple method to reduce losses by re constructing the distribution network. We study the whole network and identify the area of high technical losses and evaluate the losses. We applied HVDS methods to reconfigure the distribution substation and feeder separation.**

Keywords- *R-APDP, HVDS, LVDS, distribution transformer, Feeders, and AB cables etc.*

I. INTRODUCTION

Today we are not able to fulfil our demand of electrical power of consumers. There many challenges in this work like high T&D losses and non-realization of amount for the billed amount. After the independence of India our main concern was to increase generation and we invest major amount in increasing the generation of power. Investment in the Transmission and distribution sector was very low, as a result we lake behind in this area. Our distribution system is not able to meet present demand and supply fulfilment of consumers. Especially in the rural area we face high distribution losses due to many reasons. Old conductor and under size of cable is major cause of technical losses and faults in the rural area. Old LT feeder length has a long length more than 25 km in rural area that is the major cause of low voltage and power factor at end consumer.

Based on above fact we decided to eliminate technical losses in rural area. We collect the data from Naguran feeder from Jind district, Haryana. Our main aim in this work is to reduce the Technical losses up to nominal level and make the distribution system more reliable.

II. THEORETICAL BACKGROUND

In the 11th plan of plan of India government has decided to continue its R-APDP (Accelerated Power Development and Reforms Programme), program for sustained loss reduction in India [1, 2].

- HVDS system is the system to convert LT feeder To HT feeder to reduce power loss and reduction of the length of the feeders.
- DT is abbreviation used for Distribution Transformer; its main function is to distribute the power in the distribution area.
- Feeder may be defined as a tie line between DT and substation transformer.
- Feeder separation is process of shorting the length and increasing the no. of feeder to reduce unwanted voltage drop and losses.
- LVDS is low voltage distribution system applied for power distribution in rural area.

Today main aim of the government is to reduce loss in distribution system, so government decided to remove old system with new HVDS with the norms of R-APDP.

III. METHODOLOGY AND DATA COLLECTION

We carried out our work with a well-planned methodology.

The methodology used is shown below with a suitable diagram.

Fig.1 Methodology Diagram

1. Study of feeder and substation.
2. Layout design & study.
3. Data collection.
4. Report generation and loss calculation.
5. Purposed design.

6. Implementation of loss reduction method.

First of all we identified the different feeder of substation. After tagging of lines and DT we carried out a detailed study of design layout of the feeder. Then we collect the data of power consumption in both the feeder of substation. After collecting the data we calculate the distribution loss of the substation. Loss level provides us information about major area of losses. Then we purposed new design approach for loss reduction. During our study of the network we found that whole network can be divided in two regions, terminal T1 and Terminal T2. We carried out loss level in these two terminals.

For calculating the T&D loss we use the formula given below:-

Total Loss = DT METER ENERGY-TOTAL CONSUMPTION BY CONSUMER (Ei – Ec)… (1) [2]

Total Loss % = (Ei – Ec)*100/Ei …… (2) [2]

Ei = DT METER ENERGY.

Ec = TOTAL CONSUMPTION BY CONSUMER.

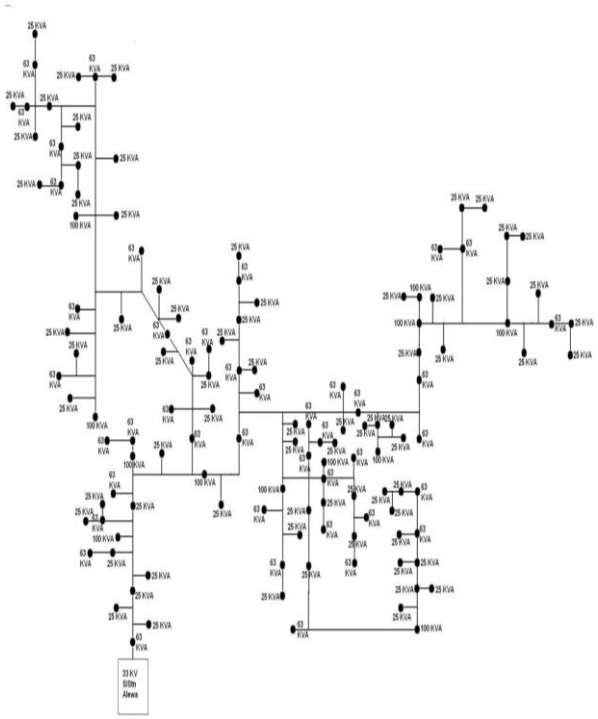

Fig. 2 Old Distribution system diagram of Feeder

Total outgoing supply from T1 = 87070+516800+13390+427890+35040+47920+802380+89370 = 2019860 kWh

Total outgoing supply from T2 = 27642+42404+42058+533380 = 645484 kWh

Losses of main-I feeder = 2019860-2019154 = 706 kWh

Percentage losses = 706/2019154*100 = 35%

Losses of main-II feeder = 645484-645167 = 317 kWh

Percentage losses = 317/642308*100 = 49%

Thus the bus-bar losses of both the feeders have been calculated in terms of percentage. There are mainly three types of consumers in the region. Their total units consumed/billed have been recorded from the log sheet and the following results have been obtained.

S.No.	Number of consumers	Type of consumer	Units billed
1	880	Domestic	233338
2	136	Commercial	52253
3	12	Small power	41045

Table 1. Details of Billed Units

Total units billed= (233338+52253+41045) kWh = 326636 kWh

Difference= (516800-326636) kWh = 190164 kWh

Percentage losses= 190164/516800*100= 37%

AAAC CONDUCTOR, Before Re networking

Sl.No. Conductor size

1 34 Sq.mm (7/2.50mm)

2 55 Sq.mm (7/3.15mm)

3 100 Sq.mm (7/4.26mm)

From the above calculation we can conclude that the substation is suffering from high level of losses. The conductor sizes of the distribution lines are also not sufficient to supply power. Power factor is also low and lastly the voltage drop at the end of distribution lines.

IV. PURPOSED DESIGN AND PARAMETERS

The Result observed from losses of the substation we evaluate the faults in the design of the substation. To reduce losses we suggest a new design which has following changes from old design:

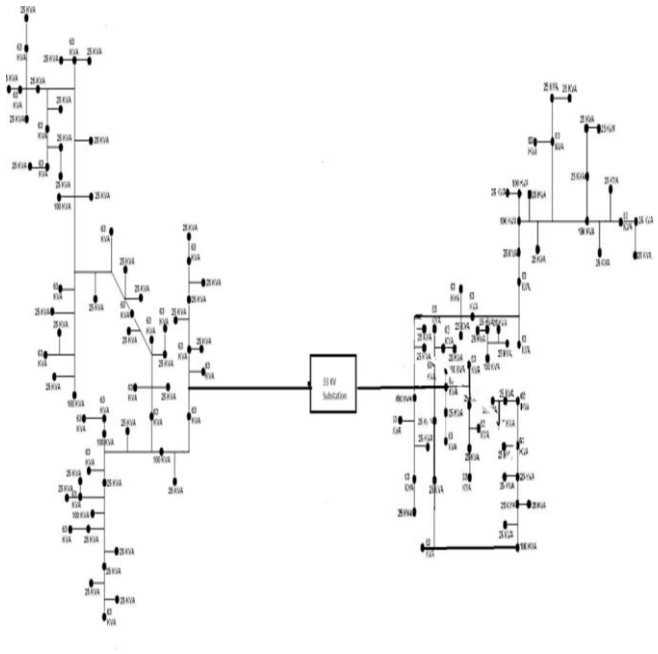

Fig.3 New Proposed 33 KV line Feeder

- The 33 KV input feeder is built in the middle of feeder.
- The entire feeders are segregated from each other.
- Lengths of feeders are reduced 3 to 10 km from 25 km.
- AAAC conductor is replaced by ACSR conductors.
- For power factor improvement Capacitor bank is also installed.
- Parallel distribution lines are given to all other rural area consumers to reduce voltage drop.

V. RESULTS

After applying the new design methodology we observe the level of substation and the result was quite positive. Our aim of reducing the loss was full filled. The level of loss was reduced up to 14%-20% in different DTs. Voltage drop at the end of long lines is also come to nominal valve above 200 V.

Secondly installing new ACSR conductors reduced the cost and improves the power distribution capacity of the substation.

ACSR CONDUCTOR, After Re networking

Sl. No	Conductor size
1	30Sq.mm (7/2.50mm)
2	50 Sq.mm (7/3.15mm)
3	100 Sq.mm (7/4.26mm)

This design improves power supply reliability and stability of the system. New conductor improve mechanical strength of the lines

VI. CONCLUSIONS AND FUTURE DIRECTIONS

So we conclude that in the old design the major portion was the technical loss due to many faulty and old technology and conductors. The design produces a method of removing losses.

The remaining loss in the system is non –technical losses. These have several reasons like theft, tapping, meter tempering and non- billing etc. so we can further work to reduce these losses. Technical loss have nominal range , now non- technical loss must be reduced.

REFERENCES

[1]www.pfcindia.com/Content/R_APDRP.aspx.and

[2] www.apdrp.gov.in

[3] Rajneesh Pawar and Jitender Singh “Calculation of T&D Loss % Based on 11/0.4 KV Substation in a Distribution Utility” 978-1-4673-0766-6/12/ 2012 IEEE.