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Reduction of Distribution Losses of The Vinayaka Feeder (11kv) Situated Between Bogadi and Basavanhalli, Mysore BY

Dr Usha Surendra[1], Heena Begum[2], Sowmyashree S[3], Ramya S[3], Vijayalakshmi[3]
[1]HOD, Department of EEE, NIE IT, Mysore, Karnataka, India
[2]Department of EEE, NIE IT, Mysore, Karnataka, India
[3]Department of EEE, NIE IT, Mysore, Karnataka, India

ABSTRACT

Losses incurred in electrical power systems have two components. technical losses and non-technical losses. This paper, presents the results of a practical case study for assessing technical losses of a distribution feeder at Bogadi Distribution Station, Mysore and appropriate solutions are suggested to reduce the losses. The optimum technique is used to find the existing losses incurred by review of the data record and field survey. Also, the total investment and the cost benefit ratio are calculated and the optimum technique to reduce the losses by adding another feeder is suggested.

Keywords. Technical and non-technical losses; KEB thumb rule (Optimum technique to calculate the losses); Cost benefit ratio;

I. INTRODUCTION

Power is generated for the consumer utilization. From when power is generated it is transmitted through transmission lines via grids & then distributed to the consumer. Power distribution is the final and most crucial link in the electricity supply chain and most visible part of the electricity sector, according to Power Grid Corporation of India Limited. At present, distribution losses is about 30%. Loss of power in distribution sector also causes increase in cost to produce more power, and the global warming concerns. Reasons for distribution losses may be due to. theft of electricity, low metering levels and poor financial health of utilities with low cost recovery, which generally causes power quality issues and increase in the cost to electricity supply. Distribution losses can be classified as Technical losses and Non-Technical losses. The technical losses are most visible losses because it is related to material properties and its resistance to the flow of current that is also dissipated as heat. The technical losses can be clearly classified as thelosses in power dissipated in distribution lines and transformers due to their internal resistance. This paper is mainly aimed at reducing the distribution losses of a feeder in the Bogadi Station, Mysore.To obtain the best possible technique. Various suggestions according to the literature survey done are as follows. Preventive and corrective maintenance should be carried out to minimize power losses on the distribution network. In addition, aged and overloaded transformers should be replaced and upgraded respectively. [1] The results of a practical case study for assessing both technical and non-technical losses of a transmission and distribution network at Southern Governorates of Jordan Distribution Electric System and

appropriate solutions and suggestions to reduce the losses. List of recommendation are presented based on losses results and also future solution is presented in this paper by using smart grid concept for energy losses reduction. [2] A practical study on technical losses in distribution system and analysis of the impact of losses in power sector. The additional energy needs to be produced and transferred to cover the technical losses. By installing the capacitor bank, resizing of conductors, shortening the distances and by phase balancing, the losses can be reduced. [3] This paper focuses on the mathematical analysis of losses that occur in electric power system. The Depezo loss formula, loss factor, use of system parameters for evaluating the system losses, the differential power loss and power flow methods are explicitly illustrated. The B-losses coefficient, which expresses the transmission losses as a function of outputs of all generation, is also explained. [4]
India has a **national grid**.

One among the most important part of an electrical grid power system is the **distribution system** that feeds the power to nearby homes and industries.
Distribution substation delivers electric energy directly to industrial and residential consumers. **Distribution feeders** transport power from the distribution substations to the end consumers' premises.

II. PRESENT STATUS

- The SRS substation at **Hootagalli**, **Mysor**e is connected to the national grid where in the voltage gets stepped down from **220kV to 66kV**.
- Thus reduced voltage is further sent to various distribution substations. One among them is situated at **Bogadi, Mysore** where the voltage is further reduced to **11kV** which is fed to consumers via the feeders.

The SLD of the Bogadi Substation is as shown below.

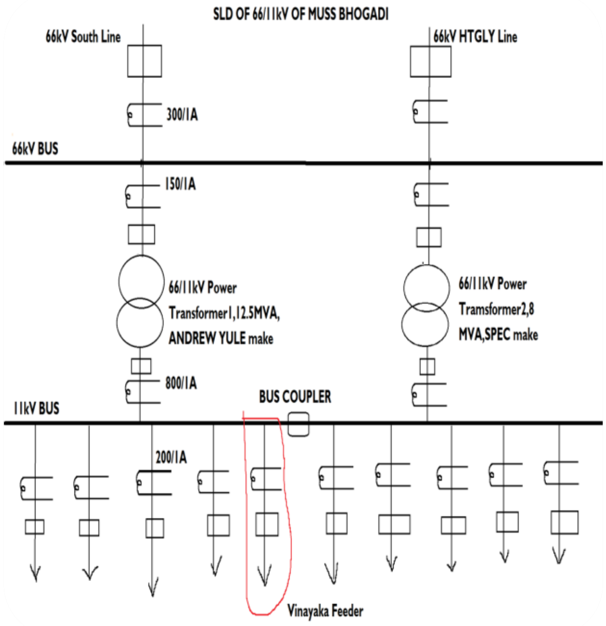

Figure 1. SLD of the Bogadi Substation, Mysore

The Actual Problem.
The Bogadi substation has 10 feeders each of 11kV. One such feeder being the Vinayaka feeder experiences a huge amount of losses.
But, for a good distribution system it's necessary to have minimum losses.

- This project is basically to analyse the total technical distribution losses of the Vinayaka feeder.
- Suggest the best possible technique to reduce the losses.
- Suggest the cost benefit ratio by estimating the cost involved for reduction of losses and time required for recovering the expenditure made to reduce the losses.

III. THE PROPOSED METHOD.

The procedure for the execution of the project is as follows.

1. Field survey is done
2. Total technical losses are estimated by using KEB Thumb rule
3. Optimum technique to reduce the losses is estimated

4. Cost benefit ratio by estimating the cost involved for reduction of losses and time required for recovering the expenditure made to reduce the losses is estimated.

1) Field survey.

A field survey is carried out from the starting point to the ending point of the feeder and a map is plotted for obtaining the exact distances between transformers and hence the total length of the feeder and hence to obtain the exact total technical losses that are occurring in the feeder.

The details obtained from the field survey are as follows.

The Vinayaka feeder has.

- ✓ Total of 63 TC's
- ✓ Out of which. 12 TC's are of 250kVA;
- ✓ 50 TC's are of 100KVA;
- ✓ 1 TC of 63kVA
- ✓ 1 TC of 25Kva

The field survey done is as shown below.

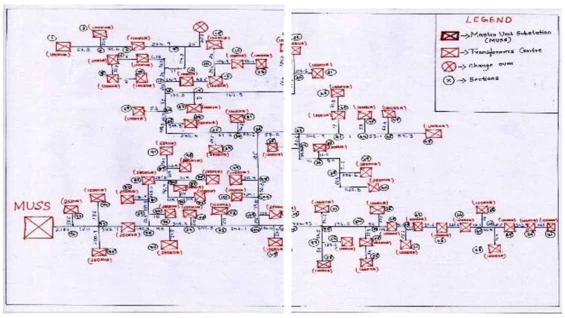

Figure 2. Field Survey Map

The field survey map is further reduced to a map as shown below by considering the point which offered maximum voltage regulation of 21.99% as the tie line.

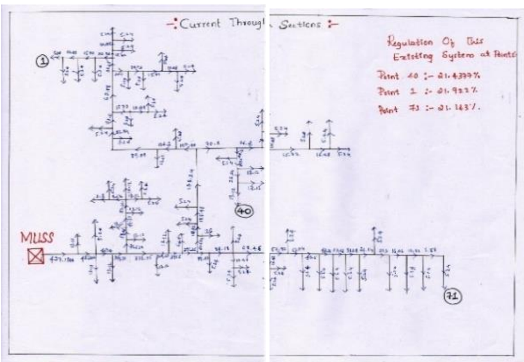

Figure 3. Survey map reduced for the calculation of Voltage regulation

Once the map above is obtained, the total existing technical losses were calculated as shown below.

Table 1. Technical Losses

Sl. No.	Section	Connected Load in kVA	Distance in km	kVAkm	Current(I) in amps	Resistance(R) in ohms	IR	I^2* R
1	1&2	100	0.0532	5.32	5.24	0.0307	0.1609	0.8429
2	2&4	200	0.0364	7.28	10.48	0.02105	0.2203	2.3119
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
96	96 & MUSS	8138	2.13	1733.94	427.1344	1.2316	526.0587	224697.7
96a	96 & 97	25	0.0556		1.312	0.3215	0.4218	0.5534
								Total= 390408.9095

2) The KEB Thumb rule used to estimate the total technical losses is as follows.

- All the points at which transformers are connected are marked as numbered points
- The kVA between points is obtained
- Distance between the points are marked
- Current through various sections are found out by finding the currents through each of the transformers as. I through a transformer of rating "X" KVA = (X * 1000) / ((3^1/2)*11*1000)
- Resistance in various sections are found out using the formula.
  R = r * distance of that section in km,
  Where,
  r = resistance of the conductor per km at 30 deg. Centigrade = 0.57824ohms
  r at 20 deg. Centigrade = 0.5465 ohms (for rabbit conductor)
  r at 30 deg. Centigrade = r at 20[1+a (30-20)]; where, a = temperature co-efficient = 0.004(a constant)
- Voltage drop in any section can be found using the formula. I*R
- Losses in each section are calculated as. I^2 * R
- Total losses of the feeder is found out, by adding up the losses in all the sections.

3) Optimum technique to reduce the losses of 11KV feeder.

Considering the availability of roads, addition of another feeder can be done in order to reduce the total technical losses currently occurring in the feeder.

When done so, the regulation of the existing feeder is found to be reduced to 10.6156%

The additional feeder added is as follows.

- A double circuit is added up to a distance of 2.915km
- One circuit feeds the all the loads up to 2.915km from the MUSS
- Another feeder continues from the end point of double circuit till the end point of the load and feeds the remaining of the 0.9371km

Losses of the system after adding the feeder are found out in the same manner as above, but for different load conditions.

Hence, we get three different tabular columns with the same contents as above. But, the loads would vary. The three tables would be.

a. The modified existing feeder
b. Additional feeder 1
c. Additional feeder 2

Losses under each of the above categories are found out to be.

i. The existing system losses gets reduced to 51033.28776 watts
ii. Losses of additional feeder 1 is found to be 41757.3956 watts
iii. Losses of additional feeder 2 is found to be 28690.1657 watts

The total technical losses are found to be reduced from 390408.9095watts to 121480.8491watts

This implies, we can save 268928.0604watts of energy by the addition of another feeder as suggested.

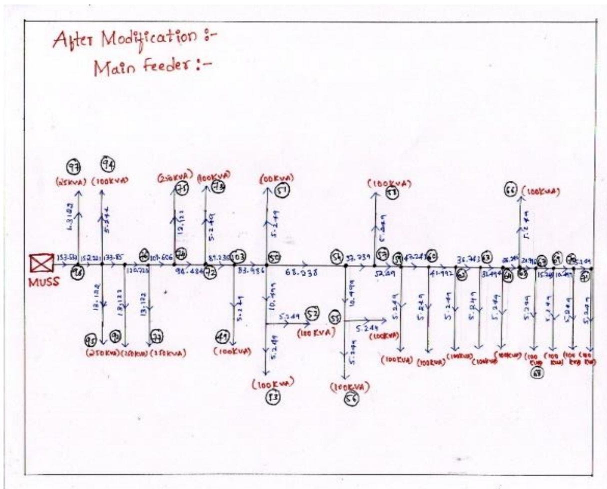

Figure 4. Suggested Modification for the existing feeder

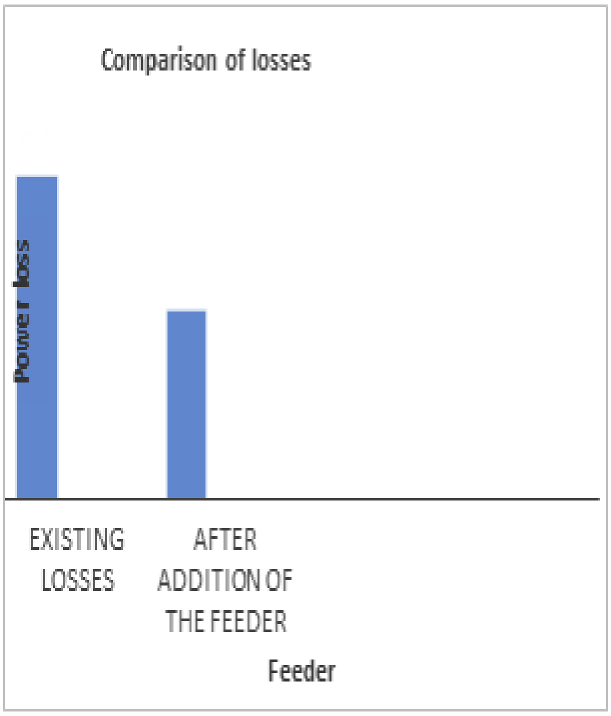

Figure 5. Comparison of Losses

4) Suggestion of the cost benefit ratio.

The existing system experiences a loss of 390408.9095 watts.

After the addition of 2 more feeders with a double circuit the losses get reduced to 121480.8491 watts.

That implies,

Savings = (Existing losses) – (Losses after the addition of new feeder)

= (390408.9095) – (121480.8491)

= 268928.0604 watts

i.e., a total of 268928.0604 watts of energy can be saved.

Considering, Rs. 4.5/- per unit energy,

We can save a total amount of. (4.5 * 268928.0604) = Rs. 12,10,176.272/- per year.

Investment for the project.

Required length of conductor.

Double circuit up to a distance of 2.915 km

The above length will serve feeder 1

Another single circuit for a length of another 0.2304 km

Per km cost of conductor with pole = Rs. 3,00,000/-

Per km cost of the double circuit

Conductor with pole = Rs. 6,00,000/-

That implies,

Total investment for the required

Length of the conductor= [(2.915* 6,00,000) + (0.2304 * 3,00,000)]

=Rs. 18,18,120/-

By saving Rs. 12,10,176.272/- per year,

We can get back the invested amount of Rs. 18,18,120/- in a span of 1.5 years.

Thereafter, we can save 2,68,928.0604 watts of energy every year and hence an amount of Rs.12,10,176.272/-

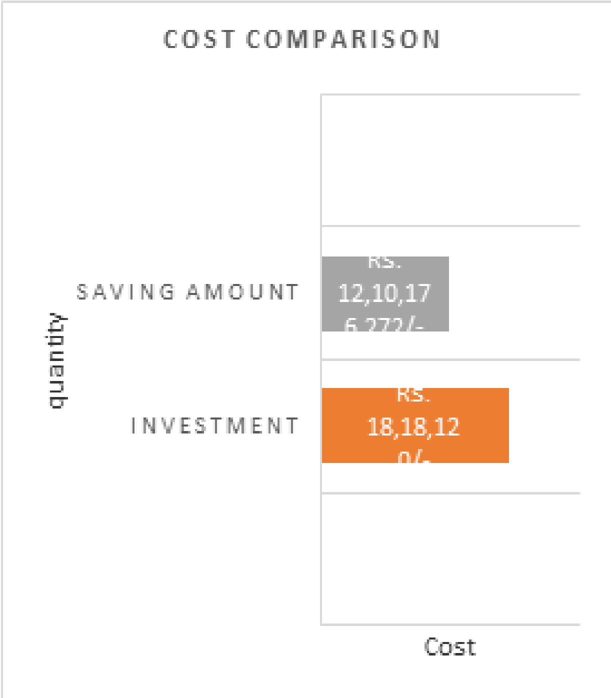

Figure 6. Cost comparison

IV. CONCLUSION

The paper demonstrates the KEB thumb rule to calculate the technical losses of a distribution feeder. It suggests the technique of addition of another feeder to the existing system in order to reduce the technical losses. It also presents the method of finding the total required investment to reduce the losses and gives a suggestion regarding the cost benefit ratio

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