

Reduction of Technical Loss on a Feeder of an Electric Cooperative in Mindanao by Feeder Reconductoring

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Abstract

Technical loss reduction program in distribution systems has been activated due to the increasing cost of electricity. These initiatives are already introduced to the cooperatives in the form of incentives and penalties. This paper focuses on the impact of technical loss reduction by reconductoring the 3-phase, 4 wire primary distribution line of a feeder with 2/0 conductor wire size to ACSR 3/0, AWG 6/1 with the total length of the overhead line 20,344.01 meters and simulated through powersolv DSAS. Simulation results showed that the implementation of this reconductoring led to an 8% reduction of the feeder technical loss. The financial viability revealed that the cost of the reconductoring project could add Php 1.20 per kWhr for 3-year recovery period and Php 0.64 per kWhr for 5-year recovery period to be added to the power bills of the consumers, but could also give rate reduction of Php 0.35 per kWhr for the 22 years for the 3-year recovery period and Php 0.37 per kWhr for 20 years for the 5-year recovery period. Feeder reconductoring is beneficial not only to the Electric Cooperative but to its consumers. A 5-year recovery period of reconductoring the feeder of the particular substation is more attractive since Php 0.64 per kWhr to be added to the power bills of the consumers is not very noticeable to affect the budget of regular earning family.

Keywords: technical loss, distribution systems, reconductoring, electric cooperative

1. Introduction

Technical power loss is consequent to the delivery of electricity from generators to end users. Since this loss is functions of current flow through the line, a technique to reduce this is by changing the wires of overhead lines with bigger conductor or reconductoring. Reducing technical loss leads to economic and financial gains, and beneficial to electrical consumers. The

Distribution System Application Software (DSAS) is a power flow simulation software that can segregate the distribution system losses immediately after a billing period as soon as new consumption data (billed energy) becomes available and was used in this study.

The Electric Cooperative (EC) understudy supplies power to more than 100,000 consumers on its franchise area, having five (5) substations with 15 feeders. The feeder considered on this study is the feeder with the biggest power consumption with 14,401 consumers which is connected to the substation that has the largest utilization of energy with more than 24,000 consumers connected on it. Figure 1 shows that the power consumption of the feeder is 11,319.4 MWhr, where 43% of it is residential, 41% low voltage and 16% high voltage consumers (Pekitpekit,2015).

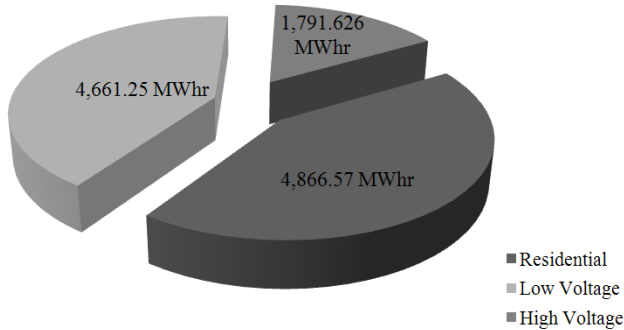


Figure 1. Feeder's Power Consumption

2. Methodology

Data were gathered, Distribution System Loss (DSL) template contained feeder's data, this is in MS Excel format and compliant to the Energy Regulatory Commission (ERC) template and then segregated through the powersolv Distribution System Application Software (DSAS), identifying the losses with relevant numerical values namely: Primary Distribution Line (PDL) loss, Secondary Distribution Line (SDL) loss, Primary Service Drop (PSD) loss, Secondary Service Drop (SSD) loss, Distribution Transformer Load (DTL) loss and Distribution Transformer No-Load (DTNL) loss. The proposed reconductoring of the existing 2/0 conductors, 3-phase, 4 wire primary distribution line of the feeder to ACSR 3/0, AWG 6/1 with the total length of the overhead line 20,344.01 meters was then simulated, segregated

and compare to the existing distribution system. The values of the technical loss was then converted into monetary units, subsequently solving for the financial analysis of the said project, as recovery period of three (3) year and five (5) years were considered and computed. A 25-year future load of the feeder was determined as well as its percentage growth rate, to use it as references to the reduction of technical loss charge that is passed-on to the consumers of the Electric Cooperative under study.

3. Results and Discussion

The monthly technical loss for the existing feeder was obtained at 94,739 kWhr, upon the implementation of the reconductoring by simulation through powersolv DSAS, the technical loss of reconductoring was 87,292.652 kWhr. Reconductoring the feeder made a great impact in the reduction of technical loss, which is equivalent to 7.447 MWhr, this was majorly due to the less resistance on the thicker wire, the PDL loss is reduced by 7.509 MWhr. All other losses slightly increased but in a very small value nearly zero (0), which is also insignificant as it could be offset by the reduction made by the PDL loss as shown in Figure 2.

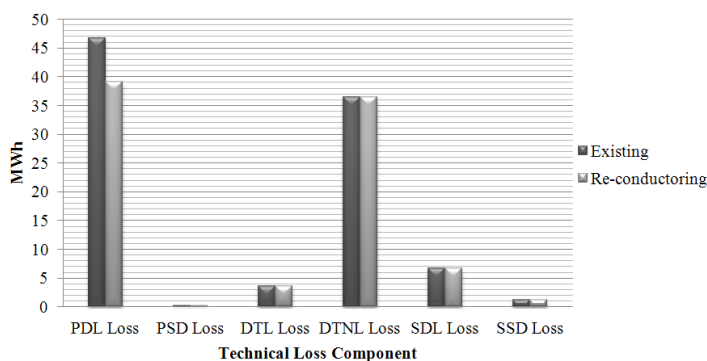


Figure 2. Segregated Technical Loss: Existing vs. Reconductoring

This overall reduction of technical loss was 8% which could bring major savings to the Electrical Cooperative and its consumers, in terms of monetary equivalent it was computed to be Php 558,150.55 in 2014. While the initial investment cost of the reconductoring project was accounted to the sum of material cost (Mabelin, 2014), labor cost (30% of material cost), contingency fund (10% of material cost) and vat cost (12% of the sum of material and labor cost), which amounted to Php 5,958,631.55. Having a

conservative assumption, at an interest rate of 6%, the future value of the capital cost in three (3) and five (5) years was computed to be Php 7,096,825.51 and Php 7,973,993.14. Table 1 shows the three (3) and five (5) years recovery period of the reconductoring project, further the effect on the power rates (Yap,2015) of the monthly cost of the project that will be passed-on per customer was Php 1.20 for three (3) years and Php 0.64 if the project is to be recovered within five (5) years.

Table 1. Recovery period of the Reconductoring Project

Recovery Period	Three (3) years (Php)	Five (5) years (Php)
Initial Cost of the project	7,096,825.51	7,973,993.14
Cost of savings over the period	1,894,392.06	3,364,545.69
Net Cost to be pass on to consumer	5,202,433.45	4,609,447.45
Monthly added Billing Rate	144,512.04	76,824.12
Monthly added Billing Rate per kWhr per consumer	1.20	0.64

Table 2 shows the profit for the reconductoring project in 22 years for a recovery period of three (3) years and 20 years for a recovery period of five (5) years. This calculated saving was the most conservative. A profit of Php 32,060,722.17 for 22 years and Php 30,590,568.54 for 20 years. And if this profit/savings of the Electric Cooperative is to be passed-on to the consumers, the consumers could be paying Php 0.35 less per kWhr for 22 years after the 3-year recovery period or Php 0.37 less per kWhr in the next 20 years after a 5-year recovery period.

Table 2. Monthly Profit/Savings of the Reconductoring Project

Profit Period	22 years	20 years
Profit during the Profit Period of the Project or savings for the entire project life (Php)	32,060,722.17	30,590,568.54
Monthly Saving (Php)	121,442.13	127,460.70
Forecasted Number of Connected Customer	343,786.61	343,786.61
Monthly Saving per customer (Php)	0.35	0.37

4. Conclusion

The study showed the impact of technical loss to the distribution of electrical energy. It was found out that at this particular feeder under study, the reduction of technical loss through feeder reconductoring could contribute to 8% loss reduction amounting to as much as Php 558,150.55 in a year. The

two recovery periods computed, three years and five years showed that the cost of the reconductoring project could add Php 1.20 for 3-year recovery period and Php 0.64 for 5-year recovery period per kWhr to the rates on every electricity consumer's power bill, but could also give a saving or rate reduction of Php 0.35 per kWhr for the 22 years for the 3-year recovery period and Php 0.37 per kWhr for 20 years for the 5-year recovery period.

Feeder reconductoring would bring profit and is advantageous not only to the Electric Cooperative but to its consumers. A 3-year recovery period is more profitable but is burden to the consumers as the additional cost of investment to be passed-on to their power bills is double compared to 5-year recovery period, the Php 1.20 per kWhr to be added to the monthly power bill of a 100 kWhr consumer is quite noticeable and could slash a significant amount to a regular earning family's budget.

Therefore, a 5-year recovery period of reconductoring the feeder of the particular substation, changing it from 2/0 conductors, 3-phase, 4 wire primary distribution line to ACSR 3/0, AWG 6/1 could reduce PDL loss and is beneficial to the Electric Cooperative and to the consumers.

5. Acknowledgement

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