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Reconciliation of Electrical Distribution System

Ajay Kumar Sharma[1], Jitender Singh[2]

[1]*(Department of Electrical Engineering, Ganga Institute of Technology and Management, Kablana, -124104, Haryana, India)*

[2]*(Department of Electrical Engineering, Ganga Institute of Technology and Management, Kablana, Jhajjar-124104, Haryana, India)*

Abstract: The techniques of Data Reconciliation have been applied to an Electrical Distribution System. These techniques have been developed in the field of electrical engineering with the purpose to optimize the losses and to reduce the revenue cost. The losses data would be reduced by exploiting the fault that are obtained from the existing system. The different feeder's data for Reconciliation have been carried out first by studying entire test rig. Generating a set of measurements. Second the real data was obtained by real measurements the losses would be optimized. This application is somehow an ideal application of Data Reconciliation. Latter since Losses are often present in the measurements from a distribution Network, a real or experimental application of Data Reconciliation was considered for a feeder. The objective was to understand if the measured values of line losses and transformer losses rate at the input and outlet of the recuperate were compatible and reliable. Measured value affected by losses was identified, focusing on its effect over all the other measurements during calculation. Hence the existing data was compared with the proposed design and then it was compared and calculated the payback period to reduce the revenue cost.

Keywords: Cables, Feeders, Power, Substation, Transformers.

I. Introduction

The Distribution System is one of the most important part of the power system [1]. It is used to deliver power from generating stations or substations to various consumers. Distribution feeders can be radial or networked.Urban distribution system is mainly underground sporadically in common benefit channel. In Rural distribution system, it is mostly above the ground with convenience poles where suburban distribution system is a mixed network [2].The Distribution system is a very huge and complex network consisting of wide range of equipment's, feeders and services. The equipment associated with the distribution system usually begins with the distribution feeder circuit breaker. The transformer and circuit breaker are usually under the jurisdiction of a substations department. The distribution feeders consist of combinations of overhead and underground conductor, three phase and single phase switches with load break and non-load break ability, relayed protective devices, fuses, transformers, surge arresters, voltage regulators and capacitors [3].

1.1 Literature Review

The power sector of India is characterized by inefficient power supply since the country independence consumers are confronted with frequent power cuts, and fluctuating voltages. In addition, to this system losses are high [4]. Since the independence India always had its rural economy. For improving the rural distribution sector there are uninterruptable governments have including energy infrastructure. There are many schemes launched and clarifying yet to attain 100% electrification in rural areas of India, still in India 67.3% including rural and urban areas electrification is considered 45% rural household that is around 75 million or above households still needs to be electrified [5]. In the few years or by 2030 we are going to face global energy need problem. The demand of load is constantly increasing which is experienced by power distribution network So, for the reliable power generation is not been preferred because of complex equipment's of power plant [6] [7].

The distribution arm of the power sector had been the domain of the sebs for a very long time which faced financial problems due to lack of efficient pricing mechanism, its implementation and collection of revenues [8]. Over and above distribution and supply losses also poses a threat consequently, the state electricity board's financial and technical difficulties led to financial problems for generating companies also [9]. A cursory look at the Report by erstwhile Planning Commission show that the average tariff over the past few years has undoubtedly increased but the rise has not been commensurate with the increase in the cost of supply. As a result, the gap between the cost of supply and the average tariff has been widening over the years. Distribution companies also make efforts to recover the shortfall of revenue due to the subsidized power supply, from the industrial and commercial consumers pay a tariff higher than the cost of supply [10].

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1.2 Defining Reconciliation

Reconciliation of electrical distribution system is the process of flowing electricity in the power system accurately allocated to buyers, suppliers and sellers for invoicing and power management [11]. This has greatly improved the power capacity, Voltage regulation, etc. However, the amount of information would be collected for further improving the power factor and accuracy and consistency of process data through a systematic data checking and treatment. The Process measurements are differing during the measurement, processing and transmission of the measured signal. The total losses in distribution system can be conveniently represented as the sum of the contributions from two types of data i.e. Existing & Proposed system.

The term Existing system implies the present distribution lines. The GPS instrument is used to survey the distributed lines. The outcome of survey can be plotted in a Map Source with GPS location data. The data would be plotted feeder wise and finally the drawings shall be generated. A different result may be obtained depending on the feeder line length, power capacity, power consumption & losses outcome of the random error. The probability distribution is the possible way for characterizing these errors. In this paper, the reconciled estimates are expected to be more thus, both Existing and Proposed system are applied together to improve the power capacity, Voltage regulation, etc. of existing data related to demand, maintenance and Operation.

II. Objective and Methodology

The main objective of this paper is to separate rural areas domestic load and for that changing to HVDS system from existing LT system although there is proposal of AB Cable [12].

- To maintain and provide the regular quality power supply o for uninterrupted power supply and quality to domestic rural consumers this will improve their living standard and their economic condition so overall company area development will be archived.
- Reduction of overall losses.
- The problem of distribution transformers failure is resolved.
- The electricity theft over distribution lines will be resolved practically.
- The unscheduled interruption of power should be cured by judicious way and charged penalty for unauthorized usage also for balancingthe load the cost for purchase of power should be reduced.
- For agriculture consumers and domestic consumers there is increase in profile of voltage.
- For agriculture consumers, the accounting of energy consumption should be upgraded.

2.1 Methodology

For reconciliation process, it is necessary to have knowledge about the procedure and ideas used for reconciliation of distribution system. The flow chart in Figure 1 gives step by step descriptions of the process involve in the reconciliation process.

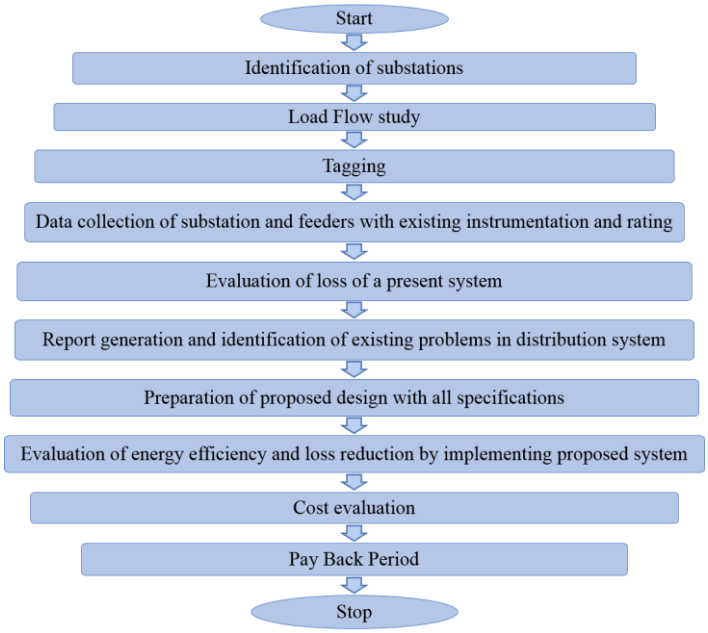

Figure 1 Flow Chart of Reconciliation Process

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2.2 Existing Research Work Data of Feeders

From the survey part of the Existing feeders Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura the obtained real data is mentioned in Table 1 Existing Research Work Data.

Sl. No	Feeder Name	DTR Rating (KVA)	Voltage (KV)	Total Load (KW)	Current (Amp)	Line Length (Meter)	Voltage Drop (volts)	Receiving Voltage (Volts)	Voltage Regulation	Average Voltage Level (Volts)
1	Bansa	500	11	349.39	22.9234	22804	64.1537	54935.85	0.5841	10987.16926
2	Bhiloni	576	11	389.27	25.53997	42420	63.81182	120936.188	0.580621	10994.19893
3	Digsar	803	11	431.64	28.31986	24724	46.40435	109953.596	0.422115	10995.35957
4	Doli	688	11	494.37	32.43557	12833	29.53574	153970.464	0.268801	10997.8903
5	Kamta	376	11	419.13	27.49908	92166	244.1006	65755.8994	2.257546	10959.31657
6	Kanakpura	714	11	602.59	39.53588	19696	49.31768	175950.682	0.448799	10996.91764

Table 1 Existing Research Work Data

2.3 Proposed Research Work Data of Feeders

From the survey part of the Proposed feeders Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura the obtained real data is mentioned in Table 2 Proposed Research Work Data.

Sl. No	Feeder Name	DTR Rating (KVA)	Voltage (KV)	Total Load (KW)	Current (Amp)	Line Length (Meter)	Voltage Drop (volts)	Receiving Voltage (Volts)	Voltage Regulation	Average Voltage Level (Volts)
1	Bansa	600	11	403.45	26.47032	26121	67.14107	98932.8589	0.611271	10992.53988
2	Bhiloni	576	11	389.27	25.53997	42420	63.81182	120936.188	0.580621	10994.19893
3	Digsar	803	11	432.35	28.36644	25036	44.68349	109955.317	0.406472	10995.53165
4	Doli	988	11	464.02	30.44431	12476	23.2751	285976.725	0.211878	10999.1048
5	Kamta	751	11	422.93	27.7484	10098	10.52237	230989.478	0.095689	10999.49893
6	Kanakpura	1227	11	618.9	40.60597	11789	10.26524	373989.735	0.093327	10999.69808

Table 2 Proposed Research Work Data

III. Results and Discussion

Total Load Comparative Results: After analysis, the collected data we have compared and obtained the following results

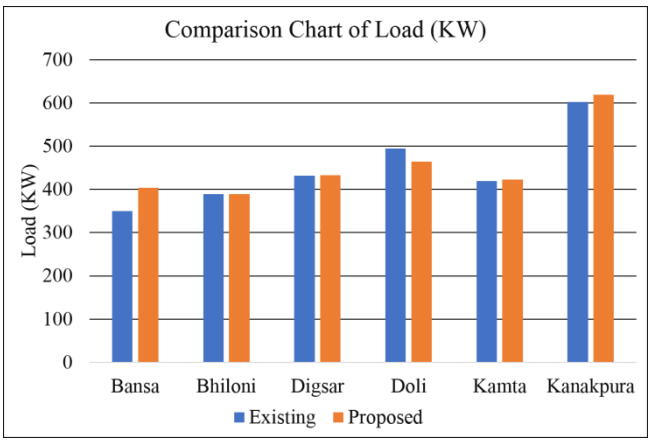

Figure 2 Comparison Chart of Load (KW)

The Existing and Proposed Voltage Drop in Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura is calculated as

Table 3 Comparison and Improvement Data of Load

S.No.	Feeder	Existing	Proposed	Improvement
1	Bansa	349.39	403.45	54.06
2	Bhiloni	389.27	389.27	0
3	Digsar	431.64	432.35	0.71
4	Doli	494.37	464.02	-30.35
5	Kamta	419.13	422.93	3.8
6	Kanakpura	602.59	618.9	16.31

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The most of feeders have satisfactory improvement in load balancing while Doli feeder showing proposed load value in decreasing trends that direct indicates the load is shifted on another feeder or removal of unauthorized consumers.

Total Current Comparative Results: After analysis, the collected data we have compared and obtained the following results

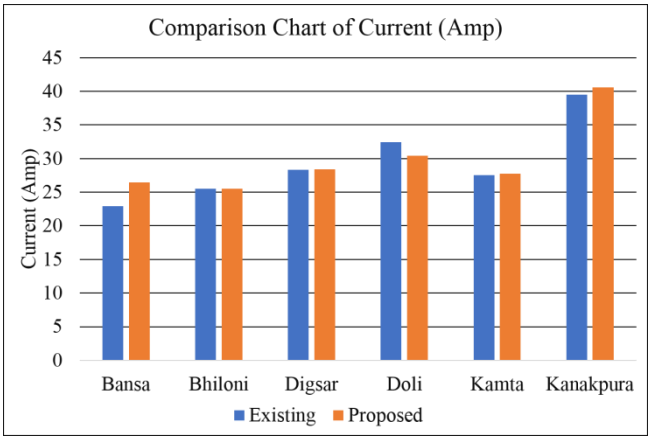

Figure 3 Comparison Chart of Current (Amp)

The Existing and Proposed Current in Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura is calculated as

Table 4 Comparison and Improvement Data of Current

S.No.	Feeder	Existing	Proposed	Improvement
1	Bansa	22.92344636	26.47031808	3.54687172
2	Bhiloni	25.53996956	25.53996956	0
3	Digsar	28.31986143	28.36644447	0.046583036
4	Doli	32.43557107	30.44431031	-1.99126076
5	Kamta	27.49908146	27.74839912	0.249317657
6	Kanakpura	39.5358755	40.60597313	1.070097628

The most of feeders have satisfactory improvement in current while Doli feeder showing proposed current value in decreasing that indicates the load is shifted on another feeder or removal of unauthorized consumers.

Voltage Drop Comparative Results: After analysis, the collected data we have compared and obtained the following results

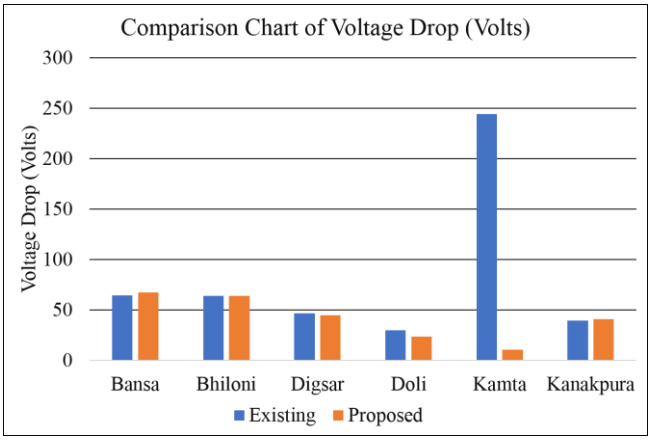

Figure 5 Comparison Chart of Voltage Drop (Volts)

The Existing and Proposed Voltage Drop in Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura is calculated as

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Table 6 Comparison and Improvement Data of Voltage Drop

S.No.	Feeder	Existing	Proposed	Improvement
1	Bansa	64.15368586	67.14106773	2.987381864
2	Bhiloni	63.81181669	63.81181669	0
3	Digsar	46.40434609	44.68349168	-1.720854409
4	Doli	29.53574345	23.27509759	-6.260645864
5	Kamta	244.1005814	10.52237291	-233.5782085
6	Kanakpura	39.5358755	40.60597313	1.070097628

In the Digsar, Doli and kamta feeders the Voltage drop value is decreasing that indicates the conductor line length is increasing.

Voltage Level Comparative Results: After analysis, the collected data we have compared and obtained the following results

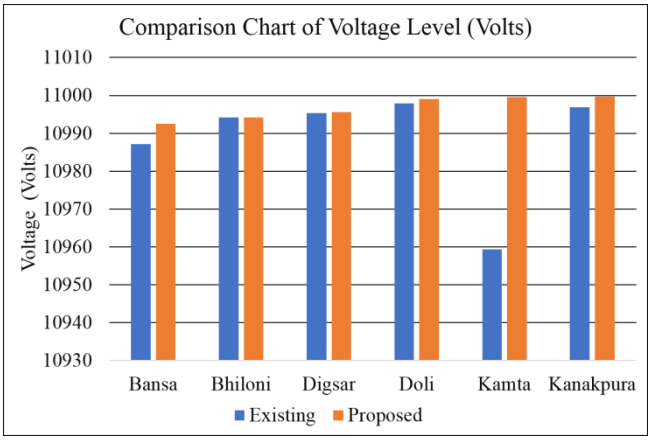

Figure 6 Comparison Chart of Voltage Level (Volts)

The Existing and Proposed Voltage Level in Bansa, Bhiloni, Digsar, Doli, Kamta and Kanakpura is calculated as

Table 7 Comparison and Improvement Data of Voltage Level

S.No.	Feeder	Existing	Proposed	Improvement
1	Bhiloni	10994.19893	10994.19893	0
2	Digsar	10995.35957	10995.53165	0.172085441
3	Doli	10997.8903	10999.1048	1.2144999
4	Kamta	10959.31657	10999.49893	40.18236485
5	Kanakpura	10996.91764	10999.69808	2.78043638

In the Digsar, Doli, kamtaandKanakpura feeders the Voltage level value is increasing that indicates the increase in efficiency.

PAY BACK PERIOD:

The payback period shall be calculated based on the cost and saving.

- Total Investment for Proposed System = Rs. 3206368 /-
- Saving in Conductor after implementing the Proposed System = Rs. 1517303/-
- Annual Saving Based on Load = Rs. 357576/
- Payback Period = Total Investment / Total Saving
  = (3206368-1517303) / 357576
  = 4.7 Years

So, The Payback period is 4.7 years.

IV. Conclusion

By applying the methodological approach of the Reconciliation process of distribution system, we have improved the load balancing, current value, Voltage level and reduced the losses and unwanted consumer loads. Also, we have obtained the information that need to identify the energy consumption patterns and components

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of an existing system conditions. By this process it is possible to identify the problems and resolving them. This is a good and beneficial process to measure and calculate the load, Voltage, Current, Conductor line length etc. to improve the power system capacity, balancing and removal of unauthorized consumers and various factors which are important for saving power and cost.

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