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GPS Interfacing of Banediya Feeder (M.P) Using MI Power Software

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ABSTRACT: In the supplying energy chain distribution networks make up the last link . For the transmission systems which feed through distribution substations usually have larger density as well as complexity. In this paper the traditional load flow studies for the 11 KV Banediya feeder which is situated Madhya Pradesh are employed for existing feeder and future distribution systems through the Mi Power software using GPS interfacing. Under this technical analysis 11 KV high tension line is furnished with 24 transformers of low tension line onto which load flow studies is performed which show that the results of losses are not as per the current norms of distribution system considering line length, capacity/conductor type and loading conditions. By using different improvements like transformer loading and resizing, change in conductor and Var compensation,for distribution networks the present load flow approach is formulated as a probabilistic power flow which takes benefit of telemeter variables and the radial nature of distribution circuits.A capital expenditure is also to be considered to make the system techno-economically feasible after considering improvements in the system.

KEYWORDS: GPS, Banediya feeder, Mi Power software, Var compensation, Rabbit cable, coyote cable.

I. INTRODUCTION

Technical analysis for the 11KV, Banediya feeder in Madhya Pradesh is furnished with 24 transformers altogether with load on low tension side of the transformers having voltage 0.415kv.The geographical digitized diagram of the 11 KV, Banediya feeder along with LT network of 0.415KV line consisting of 24 transformer rated between 25KVA, 63KVA, 100KVA, 200KVA considering 100%, 80%, 50% loading condition together with MVAr compensation is furnished in this paper. The Software is used for technical analysis are Map sourcing for interfacing GPS coordinates and Mi Power for the purpose of Load Flow Studies during different loading conditions and for MVAr compensation.

1.1 Interfacing of Banediya feeder GPS coordinates in Mi Power Software

GPS: The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

Steps involved in field survey of 11kV Feeder using GPS instruments

- Identification of particular 11kV feeder of substation.
- GPS point will be captured of each pole/DTCs of that feeder.
- Rough sketch of the feeder will be done at the spot.

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- Filling up the given format (which contains asset data of every pole & noting down technical deficiencies).
- Exporting the device data to notepad/text files.
- Interface the text files into Mi Power Software to generate the network.
- Simulate the given network and get the esired outputs,
- Improve the network as per the results.

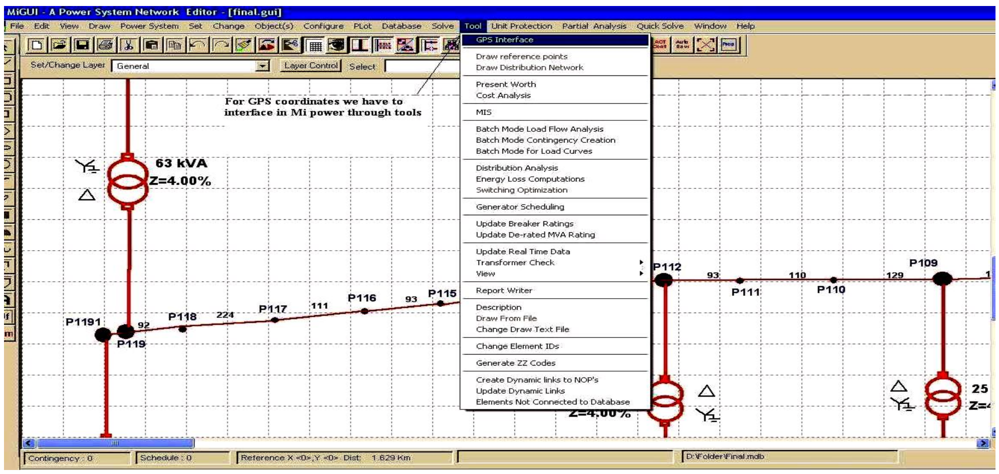

Fig.1 Snapshot of GPS Interfacing in Mi power software

Fig.1.shows the snapshot of GPS interfacing in Mi power through which the GPS interfacing as well as the different parameters has been selected.

II. TECHNICAL ANALYSIS OF BANEDIYA FEEDER LOAD FLOW STUDIES

NEED FOR LOAD FLOW ANALYSIS

One of the most common computational procedures used in power system analysis is load flow study. The planning, design and operation of power systems requires such calculations to analyse the steady-state performance of the power system under various operating conditions and to study the effects of changes in equipment configuration.
The load flow study, in general determines:
1.Component or circuit loadings

2.Steady-state bus voltages

3.Reactive power flows

4.Transformer tap settings

5.System losses

6.Performance under emergency conditions levels.

Load flow studies can be used to determine the optimum size and location of capacitors for power factor improvement. Also, they are very useful in determining system voltages under conditions of suddenly applied or disconnected load. The results of a load flow study are also starting point for several other types of studies such as short circuit, stability, motor starting and harmonic studies. The load flow results represent an initial steady-state condition for these studies.

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LOAD FLOW ANALYSIS OF THE 11 kV, Banediya FEEDER and LT 0.415KV using Load flow study

Table 3 : Results of Load Flow Study of Rabbit cable

Particulars	100%	80%	50%
Total Circuit Length(in Km's) of the 11kV feeder	12.129	12.129	12.129
Type of conductor	Rabbit/ACSR	Rabbit/ACSR	Rabbit/ACSR
Total capacity of the DTR's in KVA	1319	1319	1319
Number of feeder sections loaded beyond the rated capacity of the conductor	0	0	0
Power factor of the feeder	0.787	0.790	0.794
The minimum voltage observed at tail end in kV-HT	10.7272	10.7844	10.868
The minimum voltage observed at tail end in kV-LT	0.36769	0.37833	0.3929
The percentage voltage regulation for HT	2.48	1.96	1.2
The percentage voltage regulation for LT	11.4	8.83	5.32
Total Real power generation in kW	949.554	752.1410	463.5723
Total Reactive power generation in kVAr	745.184	584.4684	355.2411
Total Real power load in kW	907.696	726.1568	453.8480
Total Reactive power load in kVAr	680.758	544.6064	340.3790
Total Real power loss in kW	41.859945 KW	25.9831	14.8644
% real power loss	4.408	3.455	2.099

Table 3 shows the results of load flow study for a cable which is rabbit in nature which has been selected through Mi power software.

III. RESTRUCTURING OF THE SIMULATION MODEL TO BRING IMPROVEMENTS IN THE EXISTING SYSTEM

In order to restructure the existing Banediya Feeder System we need to achieve the following objectives.

I. **Transformer loading and Resizing-** As per normal conditions a transformer is not loaded not more than 50%. Transformer will generally have an overloading capacity of 200% (double their rating) but these conditions are avoided by load shedding. As per the latest distribution norms in Madhya Pradesh an agricultural feeder is given a supply of 6 hrs and a domestic consumer is given 24 hrs supply. The reason being that agricultural if they are told to use 10 HP motor, 100 HP motor will be used and to avoid the transformer failures.

II. **VAR compensation-** As we all aware that reactive power neither consumes nor supplies energy. This reactive power is a quantity which is measured in volt-ampere reactive or VARs. As the length of a line increases, its inductive reactance increases, and the more capacitive reactive power needed to offset the effect and to maintain adequate voltage.

III. **Transformer relocation / restructured-** Also known as DTC relocation. In such cases either the transformer of lower capacity will be replaced by a higher one or might be replaced by the desired one. For instance if the load demand is 60 kW it is feasible to put a100kVA transformer and not 200 kVA because the balance 100 kVA will not be used. More higher rating of the transformer more the heat losses. Similarly for 125 kW a 100 kVA transformer is not feasible so need to change the desired rating.

IV. **Changing the conductor size / type of feeder**- Changing the feeder effectively reduces the loading on the line/cable.. A Cable which can carry 4 MVA can carry 4.8 MVA depending upon 20% growth rate in the load. More the conductor size less is the impedance and better power flow with less line losses or voltage drops will occur.

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IV. IMPROVEMENTS

I. **Changing the type of Cable:** A rabbit cable can carry a maximum 3.5MVA and coyote cable can carry up to 6.8 MVA. Hence by using the coyote cable it should be beneficial from the point of improvements. Hence for changing the cable we should first go to Distribution analysis in tools of Mi Power.

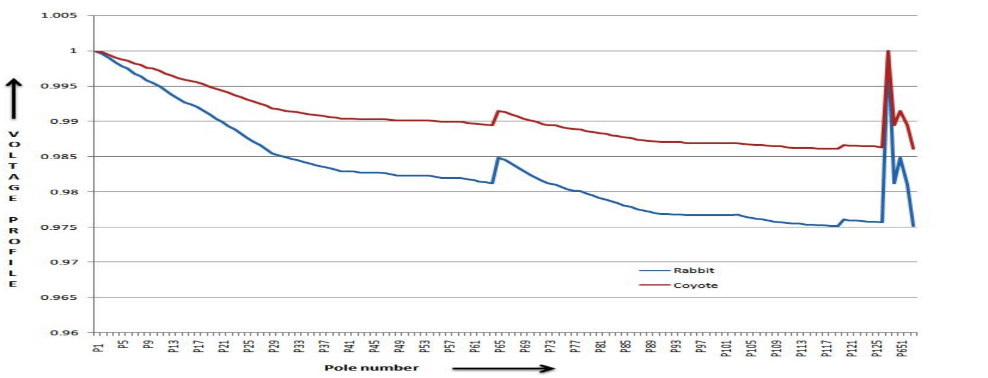

Fig 2.Changing in cable

Fig 2 shows the improvement in feeder by changing the type of cable

II. **Transformer relocation / restructured:** As we can see from the current graph that at Pole number 642 and Pole number 1261 there is a condition of overloading and by resizing the transformer the overloading would lead to balance load under normal conditions

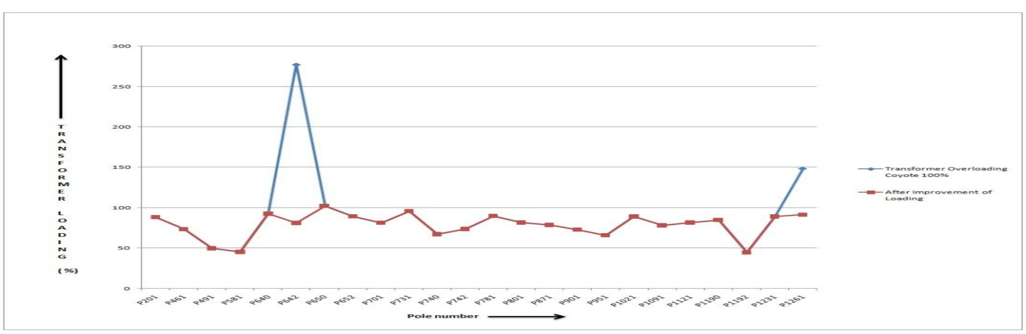

Fig 3.Graph of overloading condition

Fig 3 shows the improvement through transformer relocation/restructured through which feeder analysis has been improved.

III. **VAR compensation:** VAR Compensations are done for improving the voltages at the buses. Now since the exact compensation is not known what we can do in Mi Power compensation is available. We can choose the limits of along with steps. After entering we need to execute Optimal Load Flow using Q optimization. Once load Flow is executed in Mi Power we get the comparison results:

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Case:1 100% Loading Condition

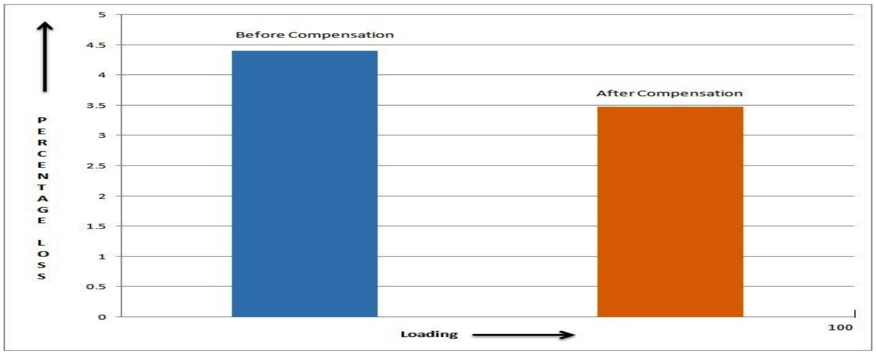

Fig 4. Comparison in Percentage losses of 100% loading and MVar condition

Fig 4.shows a comparison in percentage losses for 100% loading and MVar condition for improvements

Case 2: 80% Loading Condition

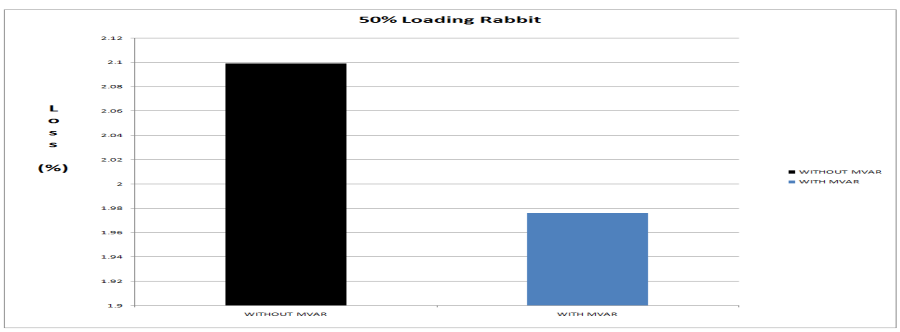

Fig 5. Comparison in Percentage losses of 80% loading and MVar condition

Fig 5. Shows a Comparison in Percentage losses of 80% loading and MVar conditions for improvements

Case 3: 50% Loading Condition

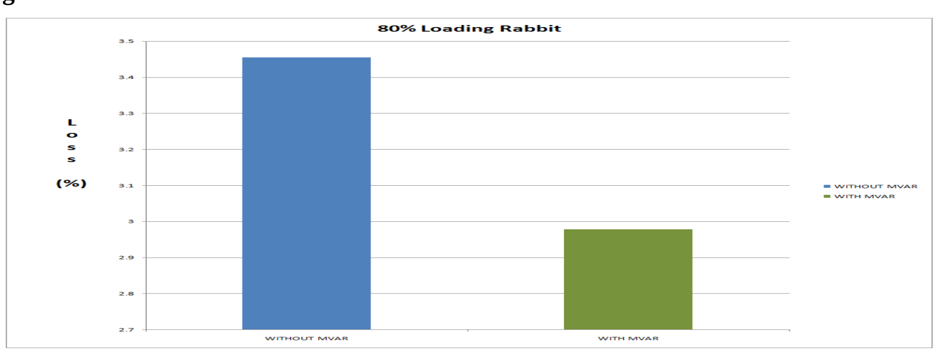

Fig 6. Comparison in Percentage losses of 50% loading and MVar condition

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Fig 6.shows a Comparison in Percentage losses of 50% loading and MVar conditions for improvement

V. CAPITAL EXPENDITURE PLAN

Interest Charges	:	14	%
O and M Charges	:	3	%
Project Life	:	10	Years
Capital Investment	:	1000000	Rs
Peak Load Power Saving(kW Losses difference between Rabbit and Coyote Conductor)	:	0.013	MW
Loss Load Factor	:	0.432	
Unit Charge	:	6	Rs/kwh
Annual Expenses	:	30000	Rs
Present Worth of Annual Expenses	:	156483	Rs
Present Worth of Cash Outflow	:	1156484	Rs
Annual Saving in Energy	:	49731	Kwh
Cost of energy saving	:	298385	Rs
Present Worth of Cash Inflow	:	1556412	Rs
Net Present Worth	:	399929	Rs
Net Benefit	:	1399929	Rs
Benefit to Investment Ratio	:	1.4	
Project is Feasible			

Table shows a capital expenditure plan which is required for analysis of feeder analysis

VI.CONCLUSION

With the help of Mi Power software and doing a simulation on the existing network of 11 kv we conclude that losses are not as per the current norms of distribution system considering line length, capacity/conductor type and loading conditions. Here with the help of transformer loading and resizing we are balancing the overloading conditions at two different poles location, which happened due to excessive loads and through the change in conductor from rabbit cable to coyote cable we are improving the voltage profile. With the help of VAr compensation we are improving the voltage profile as well as the losses present in the system.
A capital expenditure is also to be considered to make the system techno-economically feasible after considering some improvements in the system. The most essential difficulty to solve, in order to carry out this last type of study, is to provide exact values of power consumption where they are not metered. Through capital expenditure analysis we conclude that the coyote cable is more beneficial than rabbit cable as we are saving 13 KW of power.

SINGLE LINE DIAGRAM OF 11kv BANEDIYA FEEDER

This single line diagram shows the feeder of 11kv onto which a low tension line of 0.415 kv is drawn and other improvements has been done on this feeder.

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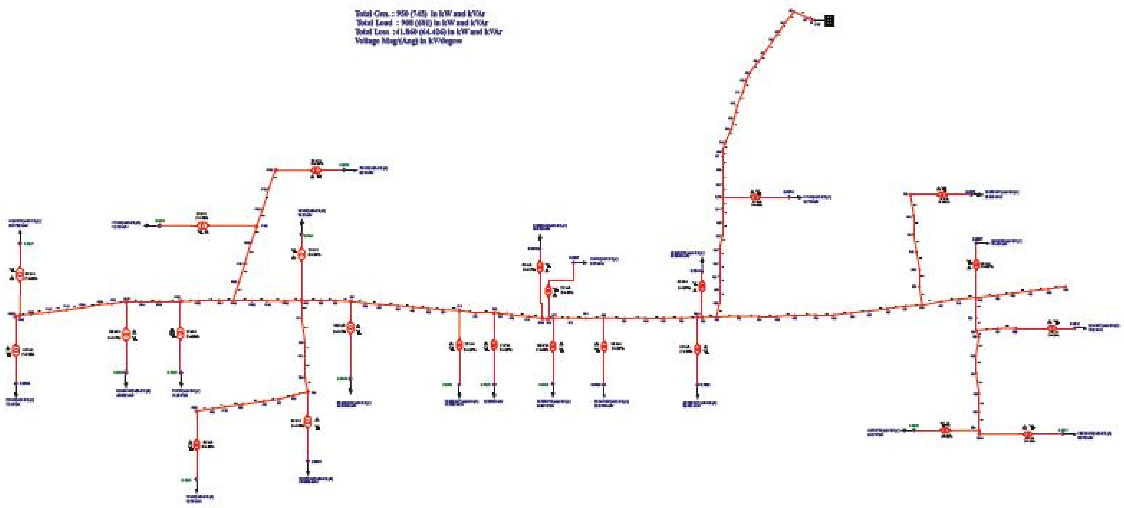

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