Load Flow Analysis and Loss Reduction Of 33/11kv Distribution Substation With Least Cost Implementation

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ABSTRACT

In present scenario the electrical demand is increasing day by day & hence it is very Important. Not only to extract the electrical energy from the all available sources but also to reduce the power losses at voltage profile improvement in existing distribution network.This project deals with the study of load flow analysis leads to reduction in power loss in distribution system.The existing distribution network & reconfiguration conditions are tabulated & that can be stored by NEPLAN software . The input are given based on real time data . collected from 33/11kv substations under MSEB. The proposed model result to load flow analysis , enhancement of voltage profile & power loss reduction for proposed system are revelved .

Keywords:- *Load Flow Analysis, MAPinr, QGIS , NEPLAN , Optimization*

1. Introduction:-

The increase in power demand and high load density in the urban areas makes the operation of power systems complicated. The power distribution topology is required to change for the better planning of primary distribution system and by increasing the substation capacity and the number of feeders according to obtain the minimal loss configuration. A significant portion of the power that a utility generates is lost in the distribution process. These losses occur in numerous small components in the distribution system, such as transformers and distribution lines. One of the major sources of losses in the distribution system is the power lines which connect the substation to the loads.

In this paper, researchers propose a method to evaluate the increasing power capacity of distribution system of loss reduction support based on the benefit-cost analysis. The costs are economic costs of loss reduction sources, which include capital investment and operating costs. The benefits from loss reduction supports are defined as the differrence in the energy is the reduction of energy loss cost due to the choice.

There are 3 types of technical losses

i. Fixed losses
ii. Variable losses
iii. Network Losses

Necessity of Load flow Analysis with Neplan:-

To begin the Voltage Stability Analysis of a power system, computation of the complex voltages at all the buses is essential. After this, power flows from a bus and the power flowing in all the transmission lines are to be calculated. A computational tool for this purpose is Load

Flow Analysis. This analysis helps compute the steady state voltage magnitudes at all the buses, for a particular load condition. Load flow is mainly used in planning studies, for designing a new network or expansion of an existing one. The

next step would be to compare the calculated values of power flows and voltage with the steady state device limits, to estimate the health of the network. This load flow can be performed on NEPLAN Software.

NEPLAN:-

NEPLAN one of the most complete planning, optimization and simulation tool for transmission, distribution, generation and industrial networks. One of the most complete planning, optimization and simulation tools for electrical networks (transmission, distribution, generation and industrial) Reliable – Efficient – User-friendly NEPLAN is the most advanced and complete Power system analysis tool and is in use all over the world. As this software is used for the planning of transmission and distribution networks, renewable energy systems or distributed systems, smart grids and generation/industrial plants, the network configuration can be laid over a geographic map, thus improving visualization and the efficiency of planning engineers. A wide range of maps can be used for this purpose such as detailed street maps, aerial and satellite images and basically any type of map data available for geographic information systems (GIS).

2. Methodology:-

In this paper, we had used three software for calculating the distance and the optimization of the feeder elements.

MAPinr is a mobile android application used for the locating exact location of the distribution transformer connected in the feeder and this can be design the file in .kmz extension and it can be imported in the QGIS windows software for the calculation of the point to point distance between transformers and overall distance of the feeder.NEPLAN is the Windows software which gives the optimal plan of the feeder in distribution substation.

3. The Simulation Study:-

For Existing System:-

High energy losses is one of the serious problem in distribution system in Yeola or all over India, where the distribution system are ageing and the distribution line are not always able to transmit the required active power due to transfer capability limits. One typical example is case of yeola 33/11kv distribution substation of India.

There are four feeders for the Yeola and we had considered one feeder i.e, Yeola 1 for the analyzation of the technical losses.

The wavepoint or the position of the transformers in the Yeola2 Feeder can be pointed by the MAPinr software and also the snapshot of the location can be captured in the software by the GIS system.

Fig1:-Feeder Yeola 1 Transformer Location on MAPinr

After that the file of the MAPinr can be saved in the .kmz extension and after that the software QGIS is opened and then the file of the MAPinr i.e, in the .kmz extension can be imported in the QGIS software and then after that the plugins can be installed after that the go to the web and then in the open layer plugins open the map either open road map or google map then the map can be viewed in the window then the new shapefile layer of line can be created then the point of the different

transformer can be connected and the total feeder system can be developed on the QGIS software. And then by using measure line command the distance between two transformer and the total distance of the feeder can be calculated.

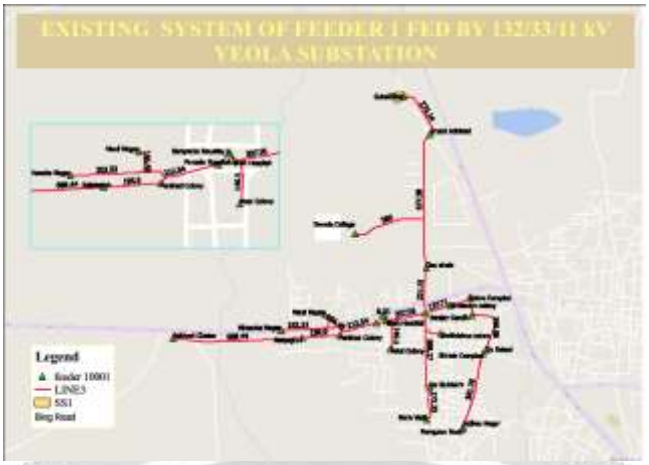

Fig2:- ExistingYeola1 Feeder with line in QGIS software

The load flow analysis can be done in the NEPLAN software. The design of the system can be done by opening the New window in NEPLAN and the by opening the symbol window in NEPLAN the Transformer And Feeder can be added with their specification and then that can be joined by Line command by providing the length and other specification of line.

Fig3:- Construction of The Existing Yeola1 feeder in NEPLAN with all Specification

After the completion of the system diagram the simulation can be started by using ctrl+ r command simulation started and the by opening the grid result window in the NEPLAN software it Provides all the results of the feeder including active, reactive, apparent power, losses, generation, etc. The grid result windows result can be copied and can be saved in the excel sheet for the further process or presentation.

From Area/Zone	P Loss kW	Q Loss kVar	P Imp kW	Q Imp kVar	P Gen kW	Q Gen kVar	P Load kW	Q Load kVar
Network	134.32	258.57	2774.72	1540.13	2774.72	1540.13	2640.4	1281.56
Area 1	134.32	258.57	0	0	2774.72	1540.13	2640.4	1281.56
Zone 1	134.32	258.57	0	0	2774.72	1540.13	2640.4	1281.56

Table 1:- Result of existing Yeola 1 feeder

For Proposed System:-

The path of distribution line is changed in the proposed system to minimize the length of the line which decreases the losses and energy can be saved and also the money can be save.

fig 4:- proposed system for Yeola Feeder 1in QGIS

After that the same changes can be made in the neplan software for the load flow analysis. And then the system can be designed and run and can shoe result as follow

Fig 5:- Proposed system in Neplan For Feeder Yeola 1

And the result of the proposed system is

From Area/Zone	P Loss kW	Q Loss kVar	P Imp kW	Q Imp kVar	P Gen kW	Q Gen kVar	P Load kW	Q Load kVar
Network	133.65	258.14	2774.05	1539.7	2774.05	1539.7	2640.4	1281.56
Area 1	133.65	258.14	0	0	2774.05	1539.7	2640.4	1281.56
Zone 1	133.65	258.14	0	0	2774.05	1539.7	2640.4	1281.56

Table 2:- Result of Proposed Feeder Yeola 1

By observing the results of the Existing and proposed system we can save the energy i.e, mimimizes the losses upto1kW and also we can save the 390 m of conductor.

4. Final selection of Substation placement plan:-

After performing simulation and analyzing the simulation result we could arrive final plan for optimal substation placement for loss reduction. It is most beneficial for installing the new substation for future. In these the technical losses reduction is saving the system.

It could be observed from study that if you make investment for addition of feeder in substation for loss reduction objective, the reduced losses would recover investment cost of the substation addition. The investment cost could be so high that it become economical not effective such a changes it should also be noted that the simulation study assumptions are made regarding the average peak hours per month. The prize of energy, the investment cost for loss reduction supports addition ,as well as ecomonic life of the transformer. The result of benefit cost analysis are based on this assumption. If this assumptions are to be alter the result of benefit cost comparison will likely change and unsuccessful iteration could become successful and vice versa. In this way, we obtain more precise data for the analyzing the load flow analysis.

5. Conclusion:-

In these paper the analysis of different technical losses data of FEEDER2 in Yeola distribution substation can be done by the load flow analysis by observing and putting the data of the feeder in the NEPLAN software, which gives the best result & better performance of the system.Using such a type of methodology improving the efficiency , reliability , regulation of the system. NEPLAN

software gives efficient result for installing new system as it provides/ shows the weak area in the system.

For installing this system according to new result given by NEPLAN, initial cost of the system is high but after the few years it gives the payback value & power system cost is improve.

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