DISTRIBUTION LOSS REDUCTION THROUGH ENERGY MANAGEMENT FOR RURAL ELECTRIFICATION

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Degree of Master of Science

Department of Electrical Engineering

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(Dr. WDAS Rodrigo)

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ABSTRACT

The Ministry of Power & Energy has taken initiative to electrify rural areas to uplift the living standard of the people in rural areas by providing the electricity, which is a basic need of people. Ceylon Electricity Board gives special concessions to in line with this by initiating number of rural electrification Projects Island wide. This increases the distribution losses by increasing the line lengths and by adding number of under loaded transformers to the power system. In this study, three main factors; selection of proper transformer capacity, effect of high tension line reconductoring, and effect of reactive power compensation are discussed in concerned to reduce the line losses in rural areas. The analysis was done as a case study for the Monaragala consumer service area. It was required to initially determine the load growth rate and the load factor for the area of concern. Load factor was obtained from the daily load curve of the passara feeder which feeds to the Monaragalaarea. The tabulated value was 0.395. The load growth rate of the area was analyzed by collecting the historical data of 167 numbers of identified transformers located in three consumer centers in the Monaragala area from year 2010. The resulted load growth rate of 0.48 was used in the analysis for data forecasting for next twenty years. The total cost of a transformer includes the initial purchase costs, maintenance cost and the cost due to losses of the transformer throughout the lifetime. The cost due to losses will be a cost for the country as a whole since this will affect to the total generation capacity to meet the country's demand. Therefore the proper selection of transformers is vital for any electrical installation. Transformer losses were forecasted for next twenty years, for different transformer capacity ratings and total costs were analyzed. If the initial peak load of the transformer is less than 30 kVA, the most economical transformer is 63 kVA. In rural distribution systems, its large number of low load consumers is distributed over a large geographical area lengthening the network and this has created more problems to the energy management. The results of the case study done for the Monaragala area clearly shows that the HT reconductoring is not economically viable, with respect to the line loss reduction in the RE network is very low. This study is focused to analyze the effect of loss reduction by reactive power compensation too. The results of this case study for Monaragala area shows that it is more feasible to install a one 1200 kvar fixed type capacitor for Passara feeder of the Badulla Grid Substation (GSS). More generalizing the outcome of this research, it can be concluded that for rural areas, which are having the load growth rate around 40% or below than that capacitor installation is economically viable and the ratings to be determined by a cost benefit analysis.

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Abbreviation	Description
CSC	Consumer Service Center
CEB	Ceylon Electricity Board
DD3	Distribution Division 3
GIS	Geographic Information System
GPS	Geographic Positioning System
GSS	Grid Substation
HT	High Tension
HV	High Voltage
IEC	International Electro technical Commission
km	kilo meter
kWh	kilo Watt hour
kvar	kilo var
LKR	Lanka Rupees
LV	Low Voltage
MV	Medium Voltage
Mn	Million
MSCADA	Micro SCADA
MV	Medium Voltage
O&M	Operation & maintenance
RE	Rural Electrification
TOC	Transformer Owning Cost
WPS II	Western Province South II