Application of 'Line Drop Compensation' To improve voltage of 33 kV Distribution Network

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By

SAMAN RANJANA KODAGODA GAMAGE

Supervised by
Prof. H.Y.R.Perera and Dr.H.M.Wijekoon

Department of Electrical Engineering
University of Moratuwa, Sri Lanka

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Declaration

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

S. R. K. Gamage

S. R. K. Gamage
Regd. No. 07/8434

Date: 01/11/2011

We/I endorse the declaration by the candidate.

Prof. H.Y.R. Perera

Date: 05/11/2011

Dr. H.M. Wijekoon Banda

13/11/2011

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Abstract

Lengthy Medium Voltage lines are typical in Rural Electrification implementations. The voltage of ends of such lines varies drastically from the time of peak loading to mid-night owing to drastic difference in line loading in Sri Lanka. Therefore consumers at end of long feeders experience very low voltages during peak loading times. Although distribution transformers come with off-load tap adjustments to buck / boost LV voltage, effective use of the full range of this tap setting is restricted due to high variation of voltage drop during the day and night. Hence these off-load tap adjustment may not fully resolve the low voltage problem of some consumers. However, if voltage at the Grid Substation Medium Voltage bus is dynamically adjusted such that voltage at some mid location of the line is maintained constant irrespective of the line load, deviation of voltage along the line can be minimized. The 'Line Drop Compensation' feature available in MK20 Voltage Regulator provides this feature.

Voltage of MV lines of Polonnaruwa and suburbs are badly affected due to long distance from Habarana Grid Substation. As a remedy, implementation of LDC in Habarana GSS has been studied. The MV network was modeled and load flow study was carried out with and without LDC for peak and off-peak times.. The voltage profiles so obtained were used for selection of optimum off-load tap of distribution transformers. The study indicates that the line end voltage is greatly improved, particularly in Polonnaruwa and suburbs, with the implementation of LDC. Hence LV terminal voltage of distribution transformers can be improved to provide customers with better voltage. Therefore, the study recommends suitable parameters of LDC for implementation at Habarana GSS.

The study also established a methodology for determining LDC parameters and verifying LDC implementation in a GSS having more than one distribution feeder.

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Abbreviations

AVR	Automatic Voltage Regulator
CEB	Ceylon Electricity Board
Dist.	Distribution
GSS	Grid Substation
HS	Heavy Supply
km	Killo meters
LDC	Line Drop Compensation
LECO	Lanka Electricity Company Limited
LTL	Lanka Transformers Limited
LV	Low Voltage
MR	Maschinenfabrik Reinhausen
MV	Medium Voltage
Nos.	Numbers
OLTC	On Load Tap Changer
PSS	Primary Substation
RE	Rural Electrification
Ref.	Reference
Trf.	Transformer
TX	Transmission
VR	Voltage Regulator