DETERMINATION OF CAPITALIZATION VALUES FOR NO LOAD LOSSES AND LOAD LOSSES OF DISTRIBUTION TRANSFORMERS

H.M.S.L. Gunarathna Bandara

(109203 X)

Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

April 2015

DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature of the author Date:
H.M.S.L.G.Bandara

The above candidate has carried out research for the Masters Dissertation under my supervision.

Signature of the supervisor Date:
Eng. W.D.A.S. Wijayapala
Senior Lecturer, Department of Electrical Engineering
University of Moratuwa

Signature of the co-supervisor Date:
Eng. S.R.K. Gamage
Deputy General Manager (DD-01)
Ceylon Electricity Board

ABSTRACT

Transformers are one of the better efficient components in the electricity distribution network. Basically substation transformers and distribution transformers are currently used in the electricity distribution network in Sri Lanka. Evaluation on the purchasing price of the transformer is not enough during the purchasing process. There are losses due to no load losses and load losses in the transformer during life which is about 30-35 years. Therefore, transformer purchaser must be look at total life time cost of the transformer during the purchasing process. Traditionally, this evaluation is done based on Total Owning Cost (TOC). Currently in Sri Lanka, CEB does not use competitive bidding process in purchasing of distribution transformers. And also, CEB has not defined capitalization values for distribution transformers to evaluate them based on TOC.

Main objective of this research is to set up a methodology to calculate capitalization values for distribution transforms in Sri Lanka using IEEE loss evaluation guide. Capitalization values for distribution transformers depend on capacity cost and energy cost, economic considerations and load profile of distribution transformers. In this research, capitalization values are calculated for three different load profiles, i.e. rural, semi urban and urban. A computer based methodology was developed to calculate capitalization values as an outcome of this research. In future, CEB can purchase distribution transformers by using these capitalization values for different applications, i.e. rural electrification, loss reduction in urban cities, augmentation of distribution transformers, etc. And also, any other utility can use computer based model to calculate capitalization values for distribution transformers at any given time corresponding to a set of economic and other parameters.

Key words

Total Owning Cost

Ceylon Electricity Board

Institute of Electrical and Electronic Engineers

ACKNOWLEDGEMENT

First and foremost, I would like to express my sincere gratitude to my supervisors Eng. W.D.A.S. Wijayapala and Eng. S.R.K. Gamage, for their continuous guidance, constructive feedback and support extended throughout this research. Despite their busy schedule, they always remained accessible and their guidance and advice, expertise and insight were by all means truly invaluable.

I would also like to thank all the panel members from the academic staff of Electrical Engineering Department of University of Moratuwa their valuable feedback during the progress reviews.

Thankfulness is extended to my friends in the Ceylon Electricity Board especially to Eng. G. Kishorkumar, Eng. H.D.S. Pathirana, Eng. I.D.J.U. Hemachandra, Eng. (MS) U.S. Gunathunga and Eng. P.M. Piyasena for the encouragement and support given to me for bringing this task to a success.

Finally, I am grateful to my mother, Udari and other family members for all the sacrifices they made along the way and for all the support given to me during various endeavors in my life.

H.M.S.L.G. Bandara
April 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
EC	Energy Cost
ET	Efficiency of Transmission
FC	Fixed Charge Rate
IEEE	Institute of Electrical and Electronic Engineers
IF	Increasing Factor
LF	Load Factor
lf	Loss Factor
LRMC	Long Run Marginal Cost
LTL	Lanka Transformer Limited
PL	Uniform Annual Peak Load
RF	Peak Responsible Factor
SC	System Capacity Cost
TOC	Total Owning Cost

LIST OF APPENDICES