

**ANALYSIS OF NON TECHNICAL LOSSES IN
DISTRIBUTION NETWORKS, MITIGATION
METHODS AND COSTS**

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University of Moratuwa, Sri Lanka.
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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

March 2014

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Nadeesha Ruwandima Ramasinghe

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Dissertation submitted in partial fulfillment of the requirements for the
Degree Master of Science

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

March 2014

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.

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.....

Signature of the supervisor Date:
(W.D.A.S. Wijayapala)

ABSTRACT

Ceylon Electricity Board (CEB) is engaged in generation, transmission and distribution of electrical energy in Sri Lanka with support from Lanka Electricity Company Ltd (LECO) for distribution in certain areas and generation support from a number of private power plants. CEB is incurring huge commercial losses annually supplying electricity to 94% of households at a unit price lower than the actual unit cost. Minimizing losses in generation, transmission and distribution is of vital importance to any utility.

Out of these losses, the distribution loss happens to be the larger component. Distribution system loss can be subdivided as Technical Loss (TL) and Non Technical Loss (NTL). The investment requirement for reducing TL is higher compared to the investment required of reducing NTL in distribution networks. This has drawn special attention for the NTL reduction programs in CEB. For devising and implementing suitable preventative and corrective actions of reducing NTL, it needs to be identified accurately. But identifying NTL is more difficult because no properly recorded information is available in many divisions in the CEB.



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The aim of this research is to study NTL in the distribution network to find mitigation measures through new technology and new systems. Causes of NTL are identified and quantified to the best possible accuracy and their impacts on NTL are discussed. Further, benefits of applying new technologies such as Aerial Bundled Conductors (ABC) and smart meters for mitigating NTL with cost benefit analysis is also included in this study. Legal framework of Sri Lanka was examined towards implementation the NTL reduction measures and some suggestions are made for future amendments to the Sri Lanka Electricity Act of 2009.

In summary, out of the 11.24% system losses in 2012, 0.64% is generation loss, 2.02% is transmission loss and 8.59% is identified as distribution loss. This study indicates that on average the 10.06% of distribution loss of energy input to Distribution Division 4 in 2012 contains 3.92% of NTL component; further details of the composition of the NTL are discussed in this thesis.

ACKNOWLEDGEMENT

First, I pay my sincere gratitude to Eng. W.D.A.S. Wijayapala who encouraged and guided me to conduct this investigation and on preparation of final dissertation.

I extend my sincere gratitude to Prof. J.P. Karunadasa, Head of the Department of Electrical Engineering and all the members of the academic staff of the Department of Electrical Engineering for the support extended during the study period.

I would like to thank Mr. P.S. Ranasinghe, Deputy General Manager (C&C) - DD4, Ceylon Electricity Board who gave me fullest cooperation and opportunity to conduct analysis of non technical losses in distribution network.

I also thank to Mrs. Chulani Gamlath, Covering Chief Engineer (P&D) - DD4, who gave me valuable instructions and encouragement during the analysis and preparation of final dissertation from start to the end.



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I would like to take this opportunity to extend my sincere thanks to Mr. Anil Ranjith, Chief Engineer (EM) - SP, Mr. Shantha Perera, Chief Engineer (Ratmalana), Mrs. Ramya Wanniarachchi, Chief Engineer (P&D) - Colombo city, Mr. Sunil Shantha, Electrical Engineer (Planning) – SP, Mr. T. Weththasinghe, Area Engineer (Ratmalana), Ms. Anusha Samapath, Electrical Engineer (Asset Management) - SP, Mr. K. Chathuranga, Electrical Engineer (Substations) - DD4, Mr. Lakshitha Wisumperuma, Electrical Engineer (Meter Lab) - DD4, Mr. Senarathne, Manager (Investigations) - CEB and all the colleagues of Ceylon Electricity Board who gave their co-operation to conduct my investigation work successfully.

It is a great pleasure to remember the kind co-operation extended by the colleagues in the post graduate program, friends, my mother, father, two sisters, brother, brother in law and sister in law and specially Wasawa who helped me to continue the studies from start to end.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ABC	Aerial Bundle Conductors
AEE	Area Electrical Engineer
CE	Chief Engineer
CEB	Ceylon Electricity Board
CSC	Consumer Service Centers
CT	Current Transformer
C&C	Commercial & Corporate
DD	Distribution Division
DGM	Deputy General Manager
EA	Engineering Assistant
EE	Electrical Engineer
EG	Embedded Generators
EM	Energy Management
ES	Electrical Superintendent
GSS	Grid Substations
HT	High Tension
IEC	International Electromechanical Commission
IM	Information Management
LECO	Lanka Electricity Company (Pvt.) Ltd
LV	Low Voltage
MH	Mini Hydro
MV	Medium Voltage
NTL	Non Technical Losses
PPM	Programmable Polyphase Meter
PT	Potential Transformer
PUCSL	Public Utility Commission of Sri Lanka
P&D	Planning & Development
SIB	Special Investigation Branch
SIN	Substation Identification Number
SP	Southern Province



TL	Technical Losses
T/F	Transformer
WPS1	Western Province South 1



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