AN EFFECTIVE METHOD OF SEGREGATION OF LOSSES IN DISTRIBUTION SYSTEMS

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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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Dr. W. D. A. S. Rodrigo

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Dr. Tilak Siyambalapitiya

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Abstract

Power system losses have turned out to be a major challenge for electricity utilities worldwide. Bulk of the losses occurs in electricity distribution. In 2012, the overall energy loss and the distribution system loss in the Sri Lanka power system were about 14% and 10% of the gross generation respectively. Before formulating strategies for loss reduction, it is essential to determine the losses at each level. Once losses are segregated, utility can clearly identify their priorities and launch effective programmes to arrest losses.

The objective of this research study is to segregate losses in a selected area of the distribution system of Ceylon Electricity Board, and evaluate an advanced metering solution in view of reduction of losses. Western Province North of which the distribution network spreads in the entire Gampaha district, Sri Lanka, was selected for the study. Accordingly, the losses were segregated into medium voltage network loss, losses in distribution transformers and low voltage network loss. The total energy loss in the distribution system was 7.1% of the energy input to the system in 2012. The loss in the low voltage network was 5.1 % of the total energy input. However, it was 15.7% of the energy input to the low voltage network itself.

A study was also carried out to determine losses in the low voltage networks of two distribution substations. The technical losses were estimated and thereby the non-technical losses were derived. The total losses were 13.9% and 8.8% of the respective energy input to the low voltage networks of the two substations. The technical losses were 5.1% and 4.8% while non-technical losses were 8.9% and 3.9% respectively. The viability of an advanced metering solution was assessed based on the same low voltage networks. Deployment of advanced metering systems solely with the purpose of arresting non-technical losses is not viable. However, viability of full scale deployment of advanced metering shall be studied at broader level considering any future requirements for time of use metering, avenues for demand side management, opportunity to reduce system peak through demand response principles, possible levels of reduction of losses and other benefits to utility and country as a whole.

Key words – Technical Loss, Non-technical loss, Load factor, Load loss factor, Advanced metering

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List of Abbreviations

Abbreviation	Description
AMI	Advanced Metering Infrastructure
CEB	Ceylon Electricity Board
CFL	Compact Fluorescent Lamps
DER	Distributed Energy Resources
DL	Distribution Licensee
GDP	Gross Domestic Production
LECO	Lanka Electricity Company Pvt. Ltd
LF	Load Factor
LLF	Load Loss Factor
LV	Low Voltage
MD	Maximum Demand
MDMS	Meter Data Management System
MV	Medium Voltage
NTL	Non-Technical loss
PLC	Power Line Communication
PUCSL	Public Utilities Commission Sri Lanka
RF	Radio Frequency
TL	Transmission Licensee
TOU	Time Of Use
UF	Utilization Factor
UTL	Utilization Time of Losses
WPN	Western Province North

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