COST EFFECTIVE RELIABILITY IMPROVEMENTS IN 33kV/11kV ELECTRICITY DISTRIBUTION NETWORKS – A CASE STUDY IN WESTERN PROVINCE SOUTH 1, CEYLON ELECTRICITY BOARD, SRI LANKA.

Degree of Master of Science in Electrical Engineering

Department of Electrical Engineering

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

Department of Electrical Engineering

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DECLARATION

I declare that this thesis is my work and to the best of my knowledge and belief there is no any material incorporated therein previously submitted for a Degree or Diploma in any other University or institute of higher learning, without giving the proper acknowledgement to that effect. It also does not contain any material previously published or written by another person except where due acknowledgement is made in the text.

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The above candidate has carried out the research for the Master thesis under my supervision.

Signature of the supervisor: Date:

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Prof. W.D.A.S Wijayapala

Late Prof. H Y Ranjit Perera

ABSTRACT

Electricity Distribution system in Sri Lanka consists of 33kV, 11kV and Low Voltage (400V/230V) networks. Providing reliable supply to the end user is a challenging task to any utility. Therefore, utility is trying to develop their network to provide a highly reliable supply to user by investing in system developments.

In this research, a method is introduced for selecting a cost-effective solution to improve the reliability of the 33kV and 11kV distribution systems among different proposals. Improvement of conductor, its insulation and protection of short duration faults are focused to develop in this research. Part of the method developed in this research, includes the software tool (DisFeeRIA) to analyze the reliability indices and cost for the relevant proposal. Data Base of the DisFeeRIA software tool includes failure rate improvement, mean time to repair, costing of each option considered etc. The analysis is done using user input of the particular feeder, data base of the software which are the part of outcome of the research.

Medium Voltage Underground cable (MVUGC), Medium Voltage Aerial Bundle Conductor (MVABC), Medium Voltage Covered Conductor (MVCC), Room Temperature Vulcanizing (RTV) Si-R coating on existing bare line ceramic insulators are considered as options for improving conductor and it's insulation. One of the latest & innovative technologies used in distribution network, Pulse closing technology is used to reduce momentary interruptions and enhance the life time of the equipment which used in distribution network.

Developed software and method were tested by case study done for Distribution network in Western Province South – 01 of Ceylon Electricity Board (CEB). Three (03) feeders were selected in different areas from Urban, Coastal & Rural.

The method that is introduced in this research is very important to utilities for planning of Electricity Distribution network.

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LIST OF ABBREVIATIONS

CEB	- Ceylon Electricity Board
LECO	- Lanka Electricity Company
MV	- Medium Voltage
LV	- Low Voltage
MVBOH	- Medium Voltage Bare Overhead
MVUGC	- Medium Voltage Underground Cable
MVABC	- Medium Voltage Aerial Bundle Conductor
MVCC	- Medium Voltage Covered Conductor
RTV	- Room Temperature Vulcanizing
Si-R	- Sillicon Rubber
UV	- Ultraviolet
HDPE	- High Density Poly Ethylene
MDPE	- Medium Density Poly Ethylene
RMU	- Ring Main Unit
GSS	- Grid Sub Station
PSS	- Primary Sub Station
F	- Feeder
LBS	- Load Break Switch
DDLO	- Drop Down Lift Off
FSD	- Fuse Switch Disconnector
HRC	- High Rupturing Capacity
MCCB	- Miniature Current Circuit Breaker
CT	- Current Transformer
PT	- Potential Transformer

ACSR	- Alluminium Conductor Steel Reinforced
AAAC	- All Aluminium Alloy Conductor
SAIDI	- System Average Interruption Duration Index
SAIFI	- System Average Interruption Frequency Index
MAIFI	- Momentary Average Interruption Frequency Index
yr	- Year
hr	- Hour
int	- interruptions
Cust.	- Customer
FOB	- Free on Board
MTTR	- Mean Time to Repair
GUI	- Graphical User Interface
GDP	- Gross Domestic Product
SPP	- Simple Payback Period
IRR	- Internal Rate of Return
BCR	- Benefit to Cost Ratio
MLKR	- Million Sri Lankan Rupee

OBJECTIVE

"Specific objective of this research is to develop a methodology for economic evaluation of reliability improvement options for 33kV/11kV Distribution Networks."