IMPACTS OF DISTRIBUTED GENERATION ON TRANSMISSION AND DISTRIBUTION LOSSES IN SRI LANKAN POWER SYSTEM

A.A.C. PRIYANGIKA

(109244X)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

September 2015

IMPACTS OF DISTRIBUTED GENERATION ON TRANSMISSION AND DISTRIBUTION LOSSES IN SRI LANKAN POWER SYSTEM

Abeysingha Arachchilage Chathuri Priyangika

(109244X)

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

Department of Electrical Engineering

University of Moratuwa

Sri Lanka

September 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 in 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).

……..

A.A.C. Priyangika Date: ……..

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

……..

Eng. W.D.A.S. Wijayapala Date: ……..

……..

Dr. H.M. Wijekoon Banda Date: ……..

ABSTRACT

According to the National Energy Policy and Strategies of Sri Lanka [1], the Government will endeavour to reach a minimum level of 10% of electrical energy supplied to the grid to be from Non- Conventional Renewable Energy sources by year 2015. Further, Government of Sri Lanka has revised the target to reach 20% of electricity supply is expected to be generated by renewable energy by year 2020.

Main Non Conventional Renewable Energy Sources available in Sri Lanka are Wind, Small hydro, Solar and Biomass. They are also called as Distributed Generation (DG) units which are located especially close to load centers of the distribution network.

When driven for such a national target as a utility, impacts of these technologies should be evaluated to maintain power quality and the stability of the power system. There are considerable impacts of DG units to utility as well as to consumers.

While improving power quality and stability, DG is a financial benefit to the utility and to the country. One of the main impacts of the DG for the utility is reduction of losses. The objective of this study is to estimate the impact of distributed generation on transmission and distribution losses in Sri Lanka power system. Transmission network and the part of the distribution network were separately studied and used to calculate the losses by using PSSE software and SynerGEE software. Badulla, Kiribathkumbura, Rathnapura and Ukuwela, grid substations with the feeders which are connected to considerable amount of DGs are selected for analysis.

According to the results, transmission network always gives a loss reduction by introducing DGs. But in distribution network, only some feeders give a positive value for the loss reduction when DGs are present.

The study shows that, when total network is considered, always there is a loss reduction and a financial benefit from DGs added to the system.

ACKNOWLEDGEMENT

My first sincere gratitude goes to my supervisors, Eng. W.D.A.S. Wijayapala and Dr. H.M. Wijekoon Banda for their great and kind guidance, insights, attention extended towards me for successful flow of the dissertation.

Next thanking is due to, course coordinator, all senior lectures, visiting lectures in the graduation programme, for their valuable teaching, guidance, assistance and co-operation delivered throughout the course.

In addition I would like to thank the officers in Post Graduate Office of Faculty of Engineering of University of Moratuwa for helping in various ways to clarify the things related to my academic works in time with excellent co-operation and guidance.

Especially I must be thankful very much to my colleagues in the Transmission Planning Branch, Distribution Region 2 and 3 of Ceylon Electricity Board for providing assistance in numerous ways to carry out the studies of the project.

I express my thanks and appreciation to my family for their understanding, motivation and patience. Lastly, but in no sense the least, I am thankful to all colleagues and friends for giving their fullest co-operation throughout the time of research and writing of the thesis.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXES