

**A SUSTAINABLE APPROACH FOR INTEGRATING
DISTRIBUTED SOLAR PV GENERATION INTO SRI
LANKAN ELECTRICAL GRID**

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Degree Master of Science by Research

Department of Electrical Engineering

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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(Prof. K.T.M. Udayanga Hemapala)

Abstract

Sri Lanka is an island with many accessible renewable energy resources. But the poor penetration of these resources to generate electricity, has continued the use of conventional power generation, resulting continuous emissions of greenhouse gases to the atmosphere. Therefore, high penetration of renewable energy could lead to minimizing the greenhouse gas emissions and petroleum dependency of a country. To achieve this, a sustainable approach is required which considers both economic and technical aspects in the long term.

In this research, a sustainable approach for integrating renewable energy into an electrical grid is proposed by using Sri Lankan electrical grid as a case study. First, the renewable energy integration models in the literature is revised and selected a suitable model for this research. Then, an economic analysis is performed by using Hybrid Optimization Model for Electric Renewable (HOMER) legacy version 2.68 to obtain the best system configuration considering cost optimization. After that, the HOMER chosen system configuration is tested for its technical compatibility. To perform the technical analysis, Open Distribution System Simulator (OpenDSS) software is used. However, solar resource is used as the only renewable energy resource in this research, due to the easiness to perform technical analysis. In the technical analysis, a real distribution feeder in Sri Lanka is modelled and tested the feeder for voltage violations while penetrating rooftop solar systems into the feeder. Also, a criterion based Photovoltaic (PV) hosting capacity is defined to the feeder as an important finding by the technical analysis.

The outcome of this research is a sustainable approach for integrating renewable energy into an electrical grid, more precisely to the distribution network of Sri Lankan grid. This approach is sustainable because it is economically and technically sustainable. Such that, this approach could be adopted to plan renewable energy integration models in long run.

Keywords – Economic Evaluation, PV Hosting Capacity, Renewable Energy Integration

Acknowledgement

I would like to express my sincere gratitude to those who were behind me in completing this research project.

I am deeply indebted to my supervisor Prof. Udayanga Hemapala, Professor, Department of Electrical Engineering, University of Moratuwa for his continuous support and encouragement from starting of this research up to writing this dissertation.

In addition, I would like to thank all the lecturers in Department of Electrical Engineering and Post Graduate Office, Faculty of Engineering, who engaged in this MSc Course in various ways to educate me and broaden my vision.

Finally, I would be thankful to my friends and family members including my parents who always encouraged and helped me to complete this research.

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List of Abbreviations

Ah	Ampere hour
COE	Cost of Energy
DG	Diesel Generator
DPV	Distributed Photovoltaic
GHG	Green House Gas
GWh	Giga Watt hour
HRES	Hybrid Renewable Energy System
kVA	kilo Volt Ampere
kV	kilo Volt
kW	kilo Watt
kWh	kilo Watt hour
LV	Low Voltage
MG	Micro Grid
NPC	Net Present Cost
PV	Photovoltaic
PVIES	Photovoltaic Integrated Energy System