

**MITIGATION OF POWER QUALITY ISSUES IN  
DISTRIBUTION NETWORK DUE TO WIND ENERGY  
PENETRATION IN KILINCHCHI AREA**

Sahidu Mohamad Kamil Parsad

(139577 X)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

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## **DECLARATION OF THE CANDIDATE AND SUPERVISORS**

I declare that this is my own work and this thesis 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: 14<sup>th</sup> May, 2018

(Dr. Asanka S. Rodrigo)

## **ABSTRACT**

Due to the significant increase of energy demand in electricity sector, many countries are switching to Renewable sources. Wind energy plays major role in renewable energy throughout the world. Since Sri Lanka has good wind potential, it is great opportunity to develop wind energy and now the government policy also has changed to develop renewable energy generation.

The high level of wind energy penetration to the grid, cause to increase power quality disturbances in distribution network such as voltage variation ,flickering, distortion of voltage and current waveform. It creates huge losses in economy as well as inconvenience of day to day activities for affected peoples in different ways. With the increment of sensitive load utilization in distribution sector, power quality measurements became as major concern.

It is understood that, a proper monitoring is need to identify mitigating mechanism for power quality measurements in distribution network in order to provide quality power to customers in line with existing standards and codes.

This postgraduate research thesis describes the power quality issues due to wind integration to the distribution network with theoretical background.

Data collection and measurements on wind power generation has been carried out and identified the issues of power quality parameters of wind plant such as voltage sag, voltage swell, lamp flickering and harmonics. The recorded power quality measurements were analyzed with existing standards and codes.

Existing power quality mitigating techniques were discussed for identified power quality disturbances.

This study proposed to install SVC ( Static Var compensator ) and passive filter at the point of common coupling.

Simulation results of developed PSCAD model proved that proposed SVC and passive filter provides power quality improvement in line with standards.

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## **LIST OF ABBREVIATIONS**

AC	- Alternating current
CEB	- Ceylon Electricity Board
DC	- Direct current
DFIG	- Doubly fed induction generator
GW	- Giga Watts
IEC	- International electromechanical commissions
IEEE	- Institute of electrical and electronics Engineers
kV	- Kilo Volt
LVRT	- Low voltage ride through
MPPT	- Maximum power point tracker
MW	- Mega Watts
NCRE	- Non Conventional renewable energy
NE	- North East
NREL	- National Renewable Energy Laboratory
NREL	- National Renewable Energy Laboratory
PSCAD	- Power System Computer Aided Design
PWM	- Pulse width modulation
Rms	- Root mean square
STATCOM	- Static Synchronous Compensator
SW	- South West
THD	- Total harmonic distortion