ANALYZING THE MAXIMUM WIND POWER PENETRATION LEVEL AROUND KALPITIYA PENINSULA

Master of Science Dissertation

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September 2010

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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28/09/2010

I endorse the declaration by the candidate.

30/09/2010
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Abstract

The Government of Sri Lanka has declared the importance of developing renewable energy in line with the national policy of maximizing indigenous sources and ensuring fuel diversity. Sri Lanka has exploited hydropower resources to almost its maximum economical potential. Only a limited number of small and medium scale hydropower plants are yet to be developed, and these are already in various stages of development. Therefore, the country is now clearly at a cross road as far as future generation is concerned.

Wind is one of the promising renewable energy options available for grid connected power. In addition, wind-mapping results for Sri Lanka shows a very good wind potential in Kalpitiya area.

This research covers the impact of wind integrations on the power system of Sri Lanka and analyzes the maximum wind penetration levels around Kalpitiya peninsula for the proposed years 2010, 2012, 2014 and 2016 transmission networks.

A steady state system analysis as well as a frequency and voltage stability analysis are used appropriately to figure out the wind penetration limits. Finally, a transient stability analysis is performed to confirm the stable operation of the wind integrated power systems.

The widely known power system simulation software package PSS®E is used to model wind turbines and perform steady state and stability analyses.

This research project concludes that 20MW; 70MW, 185MW and 220MW wind absorptions are feasible respectively in the years 2010, 2012, 2014 and 2016 at Puttlam GS/PS. Approximately 30% wind availability is considered for the steady state system analysis. In addition, 5% spinning reserve response on droop is assumed for year 2010 and 2012 and 10% spinning reserve response on droop is assumed for year 2012 and 2014.

Analyzing the most economical wind penetration limit with net work modifications is beyond the scope of this research and is open for further research study.

Acknowledgement

Thanks are due first to my supervisor, Dr. J.P. Karunadasa, for his great insights, perspectives, guidance and sense of humor. My sincere thanks also go to the officers in Post Graduate Office, Faculty of Engineering, University of Moratuwa, Sri Lanka for helping in various ways to clarify the things related to my academic work in time with excellent cooperation and guidance. Sincere gratitude is also extended to those who serve in the Department of Electrical Engineering office.

The author extends sincere gratitude to the officers in Transmission Planning Branch, Ceylon Electricity Board for their guidance and support.

This dissertation would not have been possible unless the understanding, encouragement and patience provided by my family. Therefore I owe my deepest gratitude to my family.

Lastly, I am indebted to many individuals- friends and colleagues- who have not been mentioned here personally in making this educational process a success; maybe I could not have made it without your support.

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