OUTPUT PREDICTION OF GRID-CONNECTED PHOTOVOLTAIC SYSTEM USING ARTIFICIAL NEURAL NETWORK

Thesis presented in partial fulfillment for the award of the
Bachelor in Electrical Engineering (Hons)
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

NURUL KHAIRAINI BINTI NOR ADZMAN
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM MALAYSIA

JAN 2013

ACKNOWLEDGEMENT

Bismilahirrahmanirrahim…

Alhamdulillah and thanks to Allah S.W.T the most gracious and the most merciful for his continual blessing in my life. Thanks to Allah S.W.T in giving me an opportunity to complete the Final Year Project and the thesis successfully. Thank you to all personnel which were willing to spend their time in helping me to complete this project.

I also would like to express my deep sense of gratitude and appreciation to my project supervisor Dr. Shahril Irwan bin Sulaiman for his consistent help, guidance, inspiration and giving me a spirit as a prevision of his valuable time encourage and patience during the period of completing this project. I am very grateful to my supervisor and will never forget everything he had done for me. I appreciate very much all of his kindness.

I would like also to express deepest gratitude to my parent, who always give the courage and support me along my studies. Finally, I would like to thanks to all my friends who have assisted me either directly or indirectly through this Final Year Project. The moments that we shared together are unforgettable. They have all been a constant source of strength and inspiration. I hope the knowledge that I gathered and the experience I gained from this project will help me to face the real challenge in working experience.

May Allah bless all of you.

Thank you,

… …..

Nurul Khairaini binti Nor Adzman

ABSTRACT

This project presents an artificial neural network ANN technique for predicting the output from a Grid-Connected Photovoltaic (GCPV) system. In this study, the ANN model utilizes solar irradiance (SI), ambient temperature (AT) and module temperature (MT) as it inputs while the output is the total AC power produced from the grid connected PV system. These data was collected from rooftop of Malaysian Green Technology Corporation (MGTC), Bandar Baru Bangi, Malaysia along January and October 2010. The main objective of this research is to predict AC kWh output from grid-connected photovoltaic system referring to its performance indicator. The indicators consist of root mean square error (RMSE) and coefficient of determination (R^2), which is for checking the goodness of fit. The performance of ANN model was tested using different algorithm and activation function. The number of neuron has been varied from 1-20 while the momentum rate and the learning rate varies from 0.05 until 1. Levenberg-Marquardt shows the best fit training algorithm.

TABLE OF CONTENTS

CHAPTER	LIST OF TITLE	PAGE
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	TABLE OF CONTENTS	vii
	LIST OF FIGURES	ix
	LIST OF TABLES	xii
	LIST OF ABBREVIATIONS	xiii
	LIST OF SYMBOLS	xiv
1.0	**INTRODUCTION**	1
	1.1 INTRODUCTION	1
	1.2 PROBLEM STATEMENT	3
	1.3 OBJECTIVE	3
	1.4 SCOPE OF WORK	3
	1.5 THESIS ORGANIZATION	4
2.0	**LITERATURE REVIEW**	5
	2.1 INTRODUCTION	5
	2.2 GRID-CONNECTED PHOTOVOLTAIC SYSTEM	5
	2.3 ARTIFICIAL NEURAL NETWORK	7
	2.4 PERFORMANCE INDICATOR	8
	2.4.1 Coefficient of Determination, R^2	8
	2.4.2 Root Mean Square Error, RMSE	8
	2.5 MATLAB	9
	2.6 ANALYSIS OF PREVIOUS STUDY	10
3.0	**METHODOLOGY**	11
	3.1 INTRODUCTION	11

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Grid-connected photovoltaic system (GCPV) is a system that has PV arrays that converts sunlight into DC electricity. This DC electricity is then converted into AC electricity via inverters, and this AC will be transmitted to the grid. Although there are many grid-connected PV system install worldwide, there are still a couple of problem that could by any chance slow down the promotion of the grid-connected PV system. One of the problems is the transient of the system output due to the wavering weather conditions throughout the year. Hence customers have difficulties in knowing whether the system is performing, as it should or not. Therefore, this study proposes a method to predict an expected output of the power [1].

Since the earth environment condition is unpredictable, there are a few factors that need consideration to maintain the performance of PV system. First, the variations in sun position and changing climatic conditions may cause the PV array to produce electricity less than the load demand. Naturally, the motion of the sun is dissimilar throughout the year. As a result the total irradiation received at a particular site is different from time to time. Secondly, presence of clouds and rain that will cause scattering and absorption would decrease the irradiation received at a site. Moreover, the performance of PV array is also affected by the ambient temperature and solar cell temperature [2].

In recent years, since the implementation of the grid-connected PV system, many of its users where concerned about the energy output that can be harvested from the grid-connected photovoltaic system throughout its operation [3]. Prediction of the total AC