UNIVERSITI TEKNOLOGI MARA

MODELING AND OPTIMIZATION OF THERMAL ENERGY STORAGE SYSTEM IN ENGINEERING COMPLEX, UITM SHAH ALAM

ABDUL HAFIZ BIN KASSIM

MSc

July 2014

UNIVERSITI TEKNOLOGI MARA

MODELING AND OPTIMIZATION OF THERMAL ENERGY STORAGE SYSTEM IN ENGINEERING COMPLEX, UITM SHAH ALAM

ABDUL HAFIZ BIN KASSIM

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

July 2014

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulation for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name	:	Abdul Hafiz Bin Kassim
Student ID No.	:	2010841868
Programme	:	Master of Science in Electrical Engineering (EE780)
Faculty	:	Faculty of Electrical Engineering
Thesis Title	:	Modeling and Optimization of Thermal Energy Storage System in Engineering Complex, UiTM Shah Alam
Signature of Student	:	
Date	:	July 2014

ABSTRACT

Thermal Energy Storage (TES) system has being established for quite some time and already being used in many places throughout the world. In Malaysia, several places had applied this system as an air-conditioning system in the building. Generally, TES is good for a country because it will normally reduce the overall maximum demand by distributing the load but the electricity tariff should be attractive so that the user will get the benefit. In order to make the C2 tariff more attractive, the off-peak energy (kWh) rate must be low enough and maximum demand (kW) rate should be the same with the C1 maximum demand tariff. The purpose of modeling is to be able to simulate the phenomenon between electrical energy (kWh) as the input and refrigerant ton hour (RTh) as the output. With the model, it enables the phenomenon to be predicted. The purpose of optimization is to minimize the input with certain design output or to maximize RTh output with certain energy (kWh) input. The methodology of this study is by calculating the overall cost, using C1 tariff as a benchmark to compare with the C2 tariff. The TES system in Engineering Complex UiTM is being used as the case study. The total costs that involved could be calculated. From this study, it was found that TES system uses more energy and electricity tariff play a very important role to determine its feasibility. The maximum cooling load required is 35,000 RTh with the maximum cooling load demand is 3,500 RT. Considering the optimal usage of 80%, the maximum designed need is 2,880 RT. The study shows that the present tariff set by power utility leads to a conclusion that if the cooling load storage is less than 60% of the total cooling need of a building, it is not feasible to operate TES system. Original TES design was 10,800 RTh, which is 30% which is then not feasible.

ACKNOWLEDGMENTS

Firstly, Alhamdulillah, my highest praises to Allah for His Blessings and His Strength that He has given me throughout my journey in completing this thesis. Even facing with some difficulties in completing this thesis, I still managed to complete it, Alhamdulillah. Especially to my supervisor for whom I intellectually indebted for life, Associate Professor Dr. Hj. Zainazlan Bin Md. Zain, thank you for your constant supports and invaluable guidance, there are no words that could describe how much it means to me.

My sincere appreciation and gratitude also goes to my colleagues whom I regard as my own family, thank you for all the moral supports and encouragements and most of all for having so much faith in me.

This dissertation is especially dedicated to my dearest family especially lovely parents; Kassim Bin Isop and Rosnah Bt. Mohamed Sidek, my lovely wife, Norseyrihan Bt. Mohd Sohaimi, my brothers Nizzam and Ashyraff and my sister Hasyyati for their unconditional love, understanding, never ending encouragement and financial support to proceed and complete my studies in Universiti Teknologi MARA.

Last but not least, I would like to express my deepest appreciation to my siblings, friends and to those who have been with me throughout my journey, you know who you are, thank you for the invaluable assistance, supports, love and most importantly, the friendship.

My special appreciation to Universiti Teknologi MARA, Malaysia and the Government of Malaysia for sponsoring my master studies in Universiti Teknologi MARA, Shah Alam, Malaysia.