

# **CLUSTERING OF ELECTRICITY DEMAND TO GENERATE VIRTUAL LOAD PROFILE**

This thesis is presented in partial fulfillment for the award of the  
**Bachelor of Electrical Engineering (Hons.)**  
**UNIVERSITI TEKNOLOGI MARA (UiTM)**



**MARLIAH BINTI MOSTAKIM  
FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM, SELANGOR DARUL EHSAN  
MALAYSIA.**

**JULY 2012**

## ACKNOWLEDGEMENT

In the name of Allah, the Most Beneficent and Most Merciful, Alhamdulillah because blessed me with strength, patience and time to finish this Final Year Project and accomplished my thesis writing.

First and foremost, I would like to take this opportunity to show my gratitude to my research advisor, Assoc. Prof. Dr. Zuhaina Hj Zakaria for her advices to help me for the whole process of this report. I feel blessed to have her as my advisor. I thank her for every piece of her intensive efforts that have been put into this research work.

My deepest appreciation also goes to my beloved parents and siblings, thanks a lot for your prayers and great supports that helping me to finish my Final Year Project and being accompanies during my hardest time in doing this project.

Last but not least, I also would like to express my thankful to all my friends that involve either directly or indirectly who have been supportive and giving me courage, comfort and advice during completing this thesis.

*Marliah Binti Mostakim*  
*Faculty of Electrical Engineering*  
*Universiti Teknologi MARA (UiTM)*  
*Shah Alam, Selangor Darul Ehsan*  
*Malaysia*

## ABSTRACT

Recently the emerging issue in the electric industry is effective power based on Smart Grid. To operate the power effectively, the data must be applicable and accessible, thus will produce the virtual load profile (VLP). To generate VLP clustering and classification are required. The clustering of customers electricity demand becomes important not only to design tariff but also to identify sets of standard load profile. Electricity demand means the maximum amount of electricity is being used at some time while the load profile can refer to a number of different forms of data. Clustering is one of the methods that can be used to perform the data. Clustering represent groups of customers with the same clusters are very similar and the different clusters become very distinct.

In this paper, focus is on K-means and Hierarchical for clustering electricity demand and their differences are analyzed.

**Keywords:** *Clustering, Electricity Demand, Hierarchical, K-mean, Virtual Load Profile, Smart Grid.*

## TABLE OF CONTENTS

	<b>Page</b>
<b>APPROVAL</b>	i
<b>DECLARATION</b>	ii
<b>ACKNOWLEDGEMENT</b>	iii
<b>ABSTRACT</b>	iv
<b>TABLE OF CONTENTS</b>	v
<b>LIST OF FIGURES</b>	vii
<b>LIST ABBREVIATIONS</b>	viii
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Background of Study	1
1.2 Objectives	3
1.3 Problem Statement	3
1.4 Scope of Work	4
1.5 Thesis Organization	4
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 Introduction	5
2.2 Smart Grid	5
2.3 Load Profile	6
2.4 Customer's Type	6
2.5 Classification Method	7
<b>CHAPTER 3: METHODOLOGY</b>	
3.1 Introduction on Clustering Techniques	10
3.2 Flow Chart	11
3.3 K-means Clustering	12
3.4 Hierarchical Clustering	14

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

Smart Grid is a new and intelligent power system that has wide advantage for electrical power industry [1]. With Smart Grid the real time pricing will be practical and can operate efficiently. However the implementation is more costly. Facing this reality, therefore load profiling seems the alternative solution that would provide cost-effective approach since the efficient method; the direct monitoring was required cost-prohibitive by installing time intervals meters [2].

Load profiles have been used to provide important information to support multiple functions of electric utilities for system planning and operation [3]. To perform more details of load profile, actual demand can be collected at strategic location and it can provide benefits to look for peak consumption. Load profile varied according to customers' type and will perform the graph of electrical load versus time.