

**CONSUMER BEHAVIOR ON ENERGY EFFICIENT COOLING DEVICES –  
A CASE STUDY**

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A project report submitted in partial fulfilment of the  
requirements for the award of the degree of  
Master of Science (Construction Management)

Faculty of Civil Engineering  
Universiti Teknologi Malaysia

JUNE 2013

To my beloved family, lecturers and friends,  
Thank you for your love and support.

## ACKNOWLEDGEMENT

This acknowledgement is dedicated to the following wonderful individuals who gave me invaluable assistance, guidance and contributions for the completion of this dissertation directly and indirectly.

Overall, the project was the direct result of learning from many of my lecturers. As life was a process of continuous learning and I was blessed with many good and dedicated lecturers whom nurtured the learning culture in my life. I would like to acknowledge a few of the non-academic and academic lecturers who have assisted me wherever I met the obstacles and difficulties in my educational life.

I extend my heartfelt gratitude appreciation to my supervisor, Dr. Khairulzan Yahya who has exhibited tremendous support, encouragement, inspiration, tolerance and guidance, that all in, has tremendously helped me to keep my vision and mission alive, and to pursue the completion of my Masters degree.

The dedication of this dissertation with all my love goes to all my friends and family members for their constant love, care, assurances, psychological and emotional support, patience and understanding.

Last but not least, I would like to thank the management team and residents of Sri Samudera Condominium for being supportive and participative in the survey.

Thank you.

## ABSTRACT

The energy consumption in developing countries has shown tremendous increase over the last few decades. Moreover, the nationwide final energy demand in Malaysia has increased fivefold over the last two decades due to the total population has doubled in the past 30 years. The Malaysian consumers are believed to have limited knowledge towards energy efficient (EE) products and still pose a rather low environmental conscious behaviour. Various surveys have been carried out by researchers and results have shown an increasing environmental consciousness has extending to great depth effecting consumer behaviour, which eventually expand the green product market remarkably. However no research has been carried out to finding aspects influencing consumers' tolerance towards price mark-up for green energies and goods. Therefore, this study aims to develop a better understanding of the usage of air-conditioning (AC) systems in the Malaysian households, which is believed to be useful for the advancement of house-cooling technology in Malaysia. Furthermore the study was also tries estimate the carbon emission from the selected cooling devices. This study was based on a survey in which involving 54 respondents from the residents of Sri Samudera Condominium, Johor Bahru. The study found that 9.21% of the respondents have installed the inverter-based ACs. On the other hand, 44.08% of the respondents were uncertain if their ACs is inverter-based or otherwise. They were also not aware of the benefit of inverter-based ACs. However, in average the residents are willing to pay RM1804.17 on an EE cooling device. It is found that the amount they are willing to invest in EE cooling device was not influenced by the frequency of AC usage or their household income.

## ABSTRAK

Penggunaan tenaga di negara-negara membangun telah menunjukkan peningkatan besar sejak beberapa dekad yang lalu. Permintaan tenaga di seluruh negara di Malaysia juga telah meningkat lima kali ganda sejak dua dekad yang lalu disebabkan jumlah penduduk yang telah meningkat dua kali ganda dalam tempoh 30 tahun yang lalu. Pengguna tenaga elektrik di Malaysia dipercayai mempunyai pengetahuan yang terhad dan masih menunjuk kesedaran alam sekitar yang rendah terhadap produk jimat tenaga. Pelbagai kajian telah dijalankan oleh penyelidik dan keputusan telah menunjukkan kesedaran alam sekitar yang semakin meningkat mempengaruhi tingkah laku pengguna, yang akhirnya mengembangkan pasaran produk hijau. Walau bagaimanapun tiada kajian dijalankan bagi mengkaji aspek-aspek yang mempengaruhi toleransi pengguna terhadap kenaikan harga untuk produk-produk tenaga hijau. Oleh itu, kajian ini bertujuan untuk membina pemahaman yang lebih baik bagi penggunaan sistem penghawa dingin dalam isi rumah di Malaysia demi kemajuan teknologi sistem penyejukan rumah di Malaysia. Selain itu kajian juga cuba menganggarkan kuantiti pelepasan karbon daripada peranti penyejukan yang terpilih. Kajian ini adalah berdasarkan soal selidik terhadap 54 responden terdiri daripada penduduk Kondominium Sri Samudera, Johor Bahru. Keputusan kajian menunjukkan 9.21% daripada jumlah responden memasang penghawa dingin berasaskan inverter. Manakala 44.08% daripada responden menyatakan tidak pasti yang penghawa dingin mereka berasaskan inverter atau sebaliknya serta tidak sedar tentang manfaat penghawa dingin berasaskan inverter. Walau bagaimanapun, secara purata, penduduk bersedia untuk membayar RM1804.17 untuk peranti penyejukan kecekapan tenaga tetapi jumlah yang mereka sanggup untuk melabur dalam peranti penyejukan kecekapan tenaga tidak pula dipengaruhi oleh kekerapan penggunaan penghawa dingin atau pendapatan isi rumah mereka.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of the Study

As in other industrialized and developing countries around the globe, energy use in residential buildings in Malaysia accounts for significant proportions of total energy-consumption (Wood, Newborough, 2003; Banfi *et al.* 2006).

According to Environmental Statistics 2010 for Malaysia, the total population for Malaysia is about 27 million by the year 2010. Population is growing at the rate of about 2% annually (Department of statistic and economic planning unit). Obviously, the demand for energy will also be increasing by means of time. Energy is, indeed, needed in almost all aspect of daily life (e.g. agricultural, drinking water, lighting health care, telecommunication, and industrial activities) (Sopian *et al.* 2005).

In the context of domestic use, the main energy-consuming device in the domestic electrical appliance is air conditioning systems, it relies badly upon electricity and this also results in substantial carbon dioxide emissions per household. (Wood, Newborough, 2003). Hence, the enhancement and sophistication of energy efficiency in the building and development sector is very essential in affecting one country's total energy consumption and the release of Carbon dioxide.



According to Banfi *et al.* 2006, the main elements of identifying the overall energy efficiency of a building are the features of heat insulation of the building envelope and the type of air ventilation systems used.

Wood & Newborough (2003) suggested that to enhance indoor air circulation and quality in order to achieve desire level of thermal comfort, far reaching research and development have to be carried out and proper solutions have to be implemented, for instance, the invention or combination of new technologies, discover of alternative energy source and more importantly, the consumer behaviour and energy efficiency awareness attitude, which is the main topic to be discussed in this paper.

According to Heberlein (1972), environmental attitudes had changed from an economic to a moral orientation in the industrialized societies. The importance of this observation cannot be overrated, although it is usually neglected by economists and political scientists and more importantly by most politicians (Thøgersen 1999). In fact, it is now incontrovertibly that any proportional response to today's environmental challenges will require profound changes to the way that most people in developed countries choose to live. This will impose widespread and yet far-reaching changes in individual behaviour, fundamental changes in business practice, and the implementation of ambitious new policies and regulations to drive these changes by government (Rowlands *et al.*, 2003; Menges *et al.*, 2004; Thøgersen & Crompton, 2009; Eves & Kippes, 2010). Furthermore, some property developers and marketers have already played their roles in encouraging changes in human behaviour and cultural practices to opt for greener building.

As the matter of fact, last decade has witnessed a dramatic increase in environmental consciousness worldwide. In British, Dembkowski and Lloyd (1994) found that the majority of the citizens alert that environment problem is quite serious and urgent. In addition, from another study carried out by Worcester in 1993, almost 70% of the public aware and convince that environment pollution and its

consequences are affecting their daily life negatively. In developed countries such as The United States and United Kingdom, various surveys have been carried out by researchers, e.g. Mintel survey, Green Market Alert and others and results have shown an increasing environmental consciousness has extending to great depth effecting consumer behaviour, which eventually expand the green product market remarkably (Prothero, 1990; Lawrence, 1993).

Bodo B. Schlegelmilch *et al.* (1996) suggested that one of the ways for property developers and marketers to target and then, position themselves into the arising green market is to segment the market based on the levels of pro-environmental purchase behaviour and then target the “greener” consumer segments. Thus, this paper aims to find out the public awareness of energy usage by looking at the significance of consumer socio-demographic profile and behavioural indicators in segmenting environmental conscious consumers.

## **1.2 Problem Statement**

### **1.2.1 Current Environmental Issues**

Over the past few decades, environmental issues that threaten the environment and human lives, especially those due to development, have been widely discussed and identified; these include global warming, depletion of stratospheric ozone layer, pollution of sea and rivers, noise and light pollution, acid rain and farmland erosion. One of the main causes of these problems is over-consumption of natural resources (Gardner and Stern, 2002).

### **1.2.2 Greenhouse Gasses Emissions in Malaysia**

Currently, Malaysia still largely depending on the electricity generated from non-renewable source such as coal, petroleum and natural gas (also known as fossil fuels). Carbon footprint becomes a widely used term and concept in the public debate on responsibility and abatement action against the threat of global climate change (Nation Master Statistic 2010). It has had a tremendous increase in public appearance over the last few months and previous years and is now a buzzword widely used across the media, the government and in the business world. Malaysia is ranked 30th in the world for countries that have largest amount of carbon emission. In addition, 24% from the total carbon dioxide comes from the construction industry in the country (Nation Statistics, 2010). In addition, Buildings are responsible for more than one third of total energy use and associated greenhouse gas emissions in society, both in developed and developing countries.

### **1.2.3 Buildings and Environmental Impact**

Consequently, the construction and real estate industry are forced to react and participate in overall energy reduction and sustainable housing development through efficient house construction and design, as well as upgrading the existing housing accessories to be more energy efficient and environmentally suitable (Eves & Kippes, 2010). Consumer's behaviour is an important aspect of any energy efficiency program especially in residential sector; consumer's behaviour can be a way for scaling energy efficiency. In terms of environmental Impact, especially in achieving energy efficiency in building construction there is a need to understand the available technology and focus on providing energy efficiency technological solutions. Eventhough, if the human behaviour toward the consumption of energy was less even before these efficiency technologies were used, the energy saving would be greater. It means the human behaviour should be considered as one of the solution factor in achieving greater energy efficiency. Hence, detail studies of energy-

conscious consumer behaviour are very important and have to be carried out to determine the marketability of green products or green energies.

### **1.3 Aims & Objectives of Study**

As a rule of thumb, those who are able to identify potential consumers of green products and green energy promptly and precisely will be successful in positioning and targeting themselves in this green market and gaining a profitable share from the market. Therefore, the paper aims to understand the level of environmentally conscious consumer behaviour and to profile consumers on the basis of their acceptance and willingness to pay for energy efficient cooling device in relation to the type of air ventilation system that preferred and affordable to the dweller and lastly to propose marketing strategy for energy efficient cooling devices and green electricity market.

The objectives of this study are:

- i. To understand the current consumer behaviour towards energy consumption in the selected condominium in Johor Bahru;
- ii. To examine the willingness of the residents to switch conventional AC to lower energy consumption cooling device.
- iii. To quantify and calculate the carbon emission from the residential cooling devices to measure their environmental impacts.
- iv. To suggest an alternative energy efficient cooling device option and research & development (R&D) of type of cooling system that is probably preferred and should be implemented.

## **1.4 Scope of Study**

By referring to Wood, Newborough (2003), there are basically three general routes to reduce rates of energy-consumption and carbon emissions in the residential sector as shown below:

- i. New housing project should be sustainable by adopting efficient house construction and design which is low energy consumption to minimise cooling loads;
- ii. Research and development of low energy consumption electrical appliances; and
- iii. Encourage and promote “Environmentally Conscious Consumer Behaviour”.

However, the scope of research in this paper is only focusing on reviewing the second and third statement suggested by Wood, Newborough (2003). In particular, the study will examine the type of cooling system used and preferred by the residents and their behaviour towards environmentally friendly products. Emphasis is given to determine the level of environmentally conscious behaviour and their willingness to go for green products.

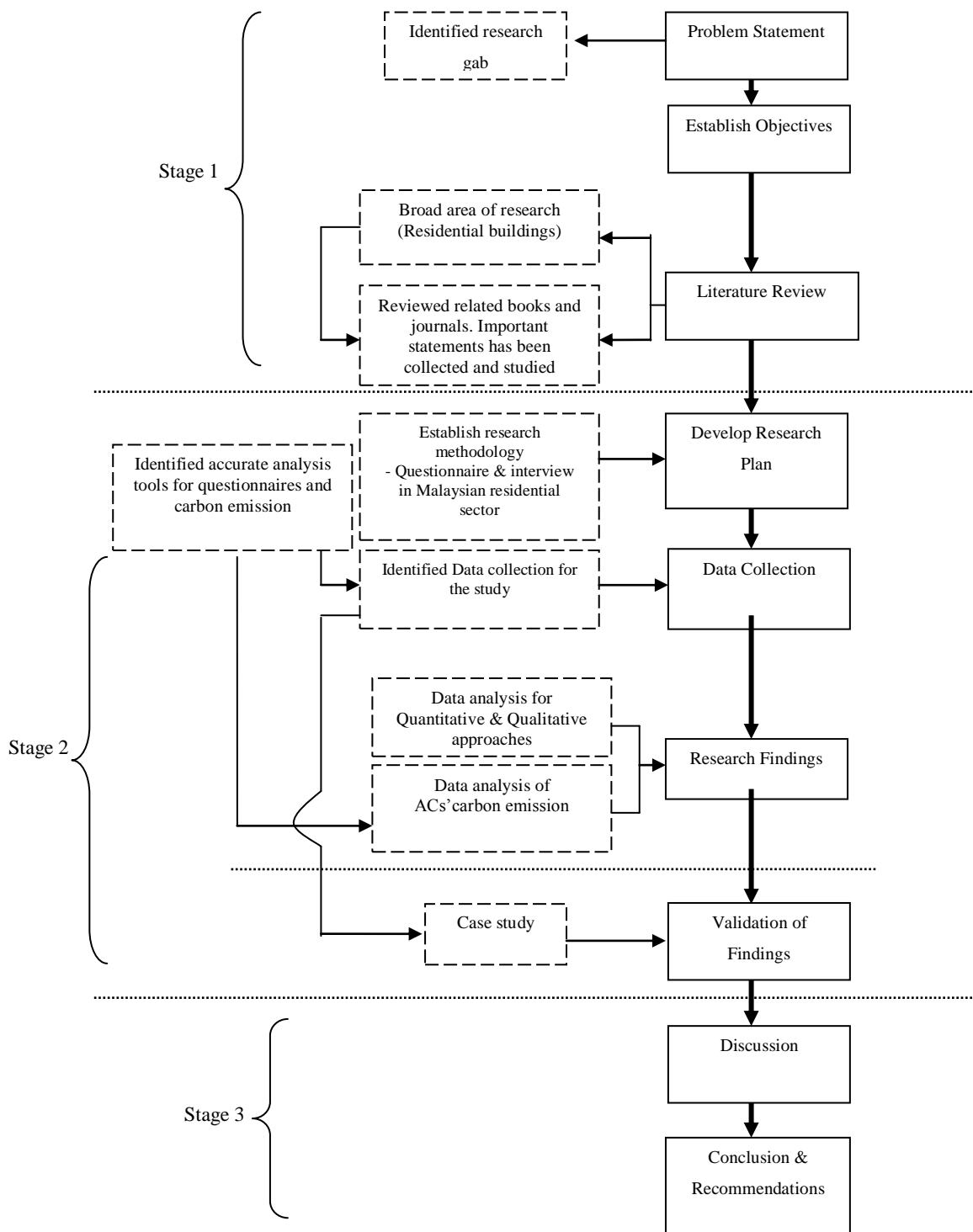
The population of respondents is only restricted to the residents in selected Condominiums at Johor Bahru in peninsular Malaysia.

## **1.5 Brief Project Methodology**

Suitable and effective research methodology is essential to guide the researchers towards achieving the research goals and objectives. To begin, the

sources of information and the ways to collecting and obtaining the data have to be identified. The research methodology of this study can be divided into three stages namely literature review, primary data collection and discussion & recommendation.

First of all, related books and journals are to be reviewed and important and significant statements given by previous researchers will be collected and studied. Then, by referring to previous researches and studies and most importantly aiming at achieving research objectives, suitable questions will be drafted and designed. Next, pilot survey or pre-test will be carried out to examine the workability and effectiveness of the questions. Necessary improvement and modification will then be done on the questionnaires to enhance feasibility and viability of the questionnaire. Subsequently, questionnaires will be distributed to collect primary information from the residents. The results of the postal questionnaires shall be analysed using Analytical Hierarchy Process (AHP) software, while the interviews shall be transcribed, and together used to draw inference and conclusions as shown in Figure 1.



**Figure 1.1:** Flow chart of research Methodology

## **1.6 Report Outline**

This study is divided into 6 chapters. The first chapter would be the introductory chapter of the report which begins with the introduction of the research background, statements of problem, aims, research objectives, scope of research and brief methodology.

Followed by Chapter 2, literature review, this chapter aims to study the findings of previous researches. This chapter will be discussing the consumer behaviour towards energy efficiency electrical appliances, market segmentation, Government's policy towards green energy and energy efficiency, Types of energy source used in Malaysia and etc.

Chapter three discusses the methodology used throughout the study together with the structure and description of the questionnaire survey. The questionnaire will aim to collect information on the respondents' attitude and awareness towards energy efficiency electrical appliances, air conditioning systems in particular.

The fourth chapter elaborates on the data collected by survey questionnaires. The fifth chapter evaluates the result of the information collected. SPSS software will be used to determine the reliability of the data gathered.

The final chapter will be concluding the overall research. Suggestion and recommendation will be proposed for future research.



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