RENEWABLE ENERGY TECHNOLOGY ACCEPTANCE IN PENINSULAR MALAYSIA

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ABSTRACT

Despite the application of a variety of policies, renewable energy resources have not developed in Malaysia. This PhD project investigates the factors that influence renewable energy technology acceptance in Malaysia, and attempts to show the impact of cost and knowledge on the perceived ease of use and the perceived usefulness of renewable energy technology. In general the aim of this study is to evaluate the impact of public perceptions (perceives of usefulness and perceived ease of use) about green technology especially renewable energy on using this kind of technology and to evaluate the impact of perceived of usefulness and perceived ease of use on the renewable energy acceptance in Peninsular Malaysia. The target population consisted of all peninsular Malaysian citizen aged 20 years and over with higher education (Includes trade and technical skills institution, post-secondary and tertiary) which is contained 21.75% of total population in this area (4893086). This study finds that the great majority of Malaysians (69.75%) have concern about term climate change. Results of this study also show that the term climate change evokes different free associations among the Malaysian public. Analysing the data indicated that 81% of respondents believe that the main cause of climate change is a human activity and Among a list of four human activities 32 % of respondents think climate change are caused mostly by emissions from vehicle and motorcycle. On the other hand analysis and results of Structural Equation Modelling (SEM) show that cost of renewable energy has an indirect effect on attitudes towards using renewable energy through the associated impact on the perceived ease of use and the perceived usefulness. The results also indicated that public knowledge in Malaysia does not affect perceived ease of use, although the positive impact of knowledge on perceived usefulness is supported

ABSTRAK

Walaupun dengan pengaplikasian pelbagai polisi, sumber-sumber tenaga boleh baharu tidak dibangunkan di Malaysia. Projek PhD ini mengkaji faktor-faktor yang mempengaruhi penerimaan teknologi tenaga boleh baharu di Malaysia, dan cuba untuk menunjukkan kesan kos dan pengetahuan tentang anggapan mudah untuk digunakan dan anggapan kebergunaan teknologi tenaga boleh baharu. Secara amnya tujuan kajian ini adalah untuk menilai kesan persepsi awam (anggapan kebergunaan dan anggapan mudah untuk digunakan) tentang teknologi hijau terutamanya tenaga boleh baharu tentang menggunakan jenis teknologi ini. Secara khususnya .Populasi sasaran terdiri daripada semua warganegara semenanjung Malaysia yang berumur 20 tahun dan ke atas dengan berpendidikan tinggi (Termasuk institusi perdagangan dan kemahiran teknikal, lepasan menengah dan pengajian tinggi) yang mengandungi 21.75% daripada jumlah populasi di kawasan ini (4893086). Kajian ini mendapati bahawa sebahagian besar rakyat Malaysia (69.75%) mempunyai kebimbangan tentang terma perubahan iklim. Hasil kajian ini juga menunjukkan bahawa terma perubahan iklim membangkitkan hubungan bebas yang berbeza di kalangan rakyat Malaysia. Selain itu analisis dan keputusan Pemodelan Persamaan Berstruktur (SEM) menunjukkan bahawa kos tenaga boleh baharu mempunyai kesan tidak langsung ke atas sikap terhadap penggunaan tenaga boleh baharu melalui kesan yang berkaitan pada anggapan mudah digunakan dan anggapan kebergunaannya. Keputusan juga menunjukkan bahawa pengetahuan orang ramai di Malaysia tidak menjejaskan anggapan mudah digunakan, walaupun kesan positif pengetahuan tentang anggapan kebergunaannya disokong

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LIST OF SYMBOLS AND ABBREVIATIONS

AMOS	:	Analysis of Moment Structure
AGFI	:	Adjusted Goodness-of-Fit
AVE	:	Average Variance Extracted
CFA	:	Confirmatory Factor Analysis
CR	:	Composite Reliability
GFI	:	Goodness-of-Fit Index
PEOU	:	Perceived Ease-Of-Use
PU	:	Perceived usefulness
RE	:	Renewable Energy
RMSEA	:	Root Mean Square Error of Approximation
SEM	:	Structural Equation Modelling
SD	:	Standard Deviation
SE	:	Standard Error
SPSS	:	Statistical Package for Social Science
TAM	:	Technology Acceptance Model

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter provides an introduction to the scope of this thesis. It is divided into nine sections. Following the introduction, section 1.2 presents issues related to the research background, and the third section specifies the research problem. Sections 1.4 and 1.5 describe the research questions and objectives, and section 1.6 describes their significance. Section 1.7 presents the research method and analysis. Research boundaries are presented in section 1.8, and an outline of this thesis is provided in section 9.

1.2 Research Background

For the enhancement of wealth and economic growth, developing countries need increased access to energy. At the same time, the world is suffering from a tenacious energy crisis reinforced by high oil prices and the effects of global climate change. As a result of these global issues, the concepts of green economy, green technology, and renewable energy technology have become central to policy debates in recent years.

Green technology can be defined as "an initiative involving various kinds of methodologies and material enhancement, from techniques for generating energy to non-toxic cleaning products" (Kamarudin et al., 2011, p.1).

The main goal in the rapidly growing field of green technology is the sustainability of economic development. Governments and the Word Energy Council (WEC) are playing key roles in developing and implementing wide-ranging green technology efforts that meet the needs of society without damaging or depleting natural resources. For development to be sustainable in the new global economy, the delivery of energy services needs to be secure and have low environmental impacts. Consequently, green technology has become a central issue in addressing the abovementioned needs without compromising future generations' ability to meet their own needs.

In moving towards a green technology, Renewable Energy (RE) plays an important role. Renewable energy presents major economic opportunities and makes a major contribution to energy security, providing energy services in a sustainable manner and, in particular, mitigating climate change. The estimated renewable energy share of global final energy consumption in 2013 is presented in Figure 1.1.

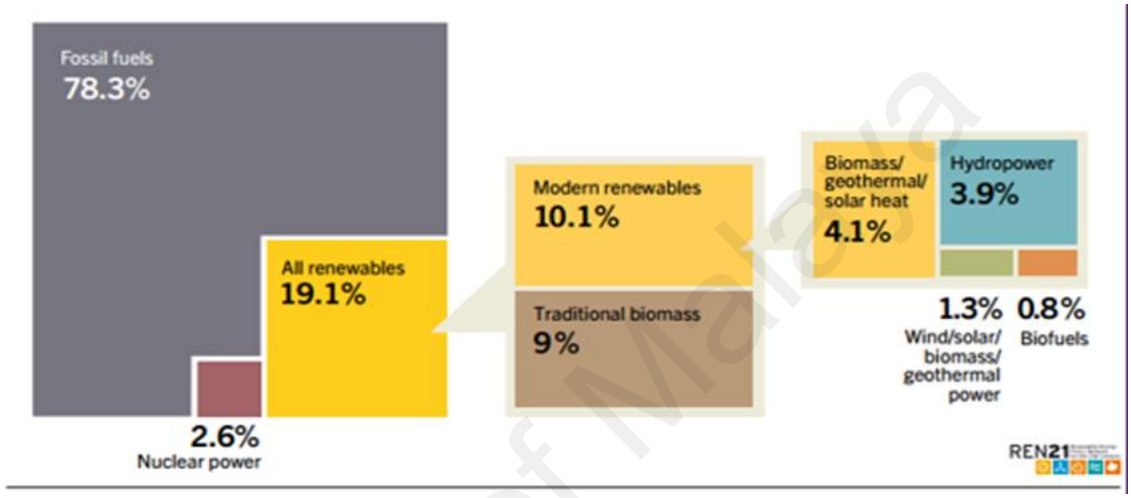

Figure 1.1: Renewable Energy share of Global Energy Consumption, 2013
Source: REN21

As a country in Southeast Asia with a population of 28 million "Malaysia was formed in 1963 through a Federation of the former British colonies of Malaya and Singapore, including the East Malaysian states of Sabah and Sarawak on the northern coast of Borneo and West Malaysia (that is also known as Peninsular Malaysia)"(Krdooni et al., 2014,p.283).

Since access to clean and reliable energy constitutes an important prerequisite for fundamental determinants of human development, contributing, inter alia, to economic activity, income generation, poverty alleviation, health, education, and gender equality, interest in developing a renewable energy policy has increased in Malaysia over the past 15 years. With the exception of periods of economic depression, Malaysia as a developing country, has been growing rapidly over the last two decades.

In the Malaysian context, with rapid economic growth, growing energy demands, and the increasing threat of climate change, moving towards using green technology and (especially) renewable energy is justified based on the fundamental objective of obtaining a safe, cost-effective, environmentally friendly, and secure energy supply.

It is assumed that the Malaysia population will grow at an average rate of 2.3% annually from 2010 until 2020 and 2.1% from 2020 to 2030. The total population is expected to reach 39.4 million by 2030. Malaysia's GDP is expected to grow by about 3.8% per annum from 2007 to 2030 (Olz, 2010). The combined GDP of the ten ASEAN member (Association of Southeast Asian Nations) is shown in Table 1.1.

Table 1.1: GDP growth rates by country in ASEAN

	1990-2011	2011-2020	2020-2035	2011-2035
Indonesia	4.7%	6.2%	4.2%	4.9%
Malaysia	5.8%	5.0%	3.4%	4.0%
Philippines	3.8%	5.6%	4.1%	4.6%
Thailand	4.2%	4.9%	3.8%	4.2%
Rest of ASEAN	6.7%	4.9%	4.4%	4.6%
ASEAN	5.0%	5.5%	4.1%	4.6%

Sources: OECD (2013)

Both population and GDP growth increase energy needs. It is important to note that the total energy demand in Malaysia grew at an average annual growth rate of 6.6%, from about 5114 ktoe (kilotonnes of oil equivalents) in 1980 to 41,476 ktoe in 2010.

Fig.1.2 illustrates the annual growth rate of the total energy demand in Malaysia for 1980–2010. Final energy consumption in Malaysia is projected to grow at an annual growth rate of 3.3% from 2007 to 2030 in the BAU (Business as usual) scenario. (Kardooni et al., 2016).

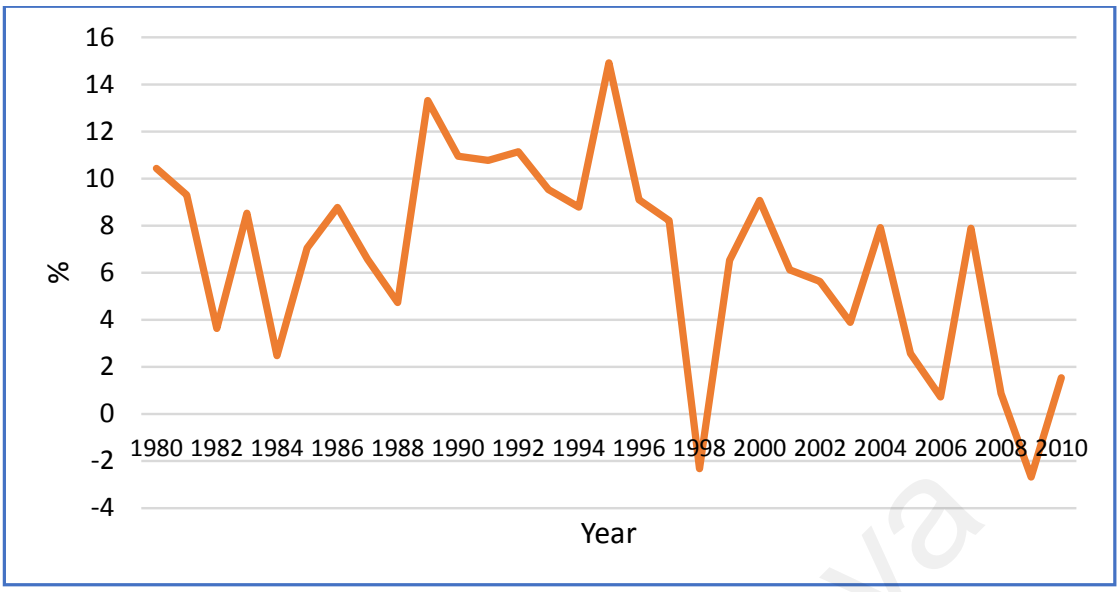

Figure 1.2: Annual growth rate of the total energy demand in Malaysia -1980–2010
Source: Malaysia Energy Information Hub, http://meih.st.gov.my/statistics.

It is almost certain that the escalated growth in energy demand motivated by population and GDP growth will take place in Malaysia. Furthermore, the high consumption of energy in Malaysia increases pollution. According to the International Transport Forum (ITF), Malaysia is one of the top 10 CO_2-emitting non-ITF economies (ITF, 2010). Figure 1.3 illustrates this point clearly.

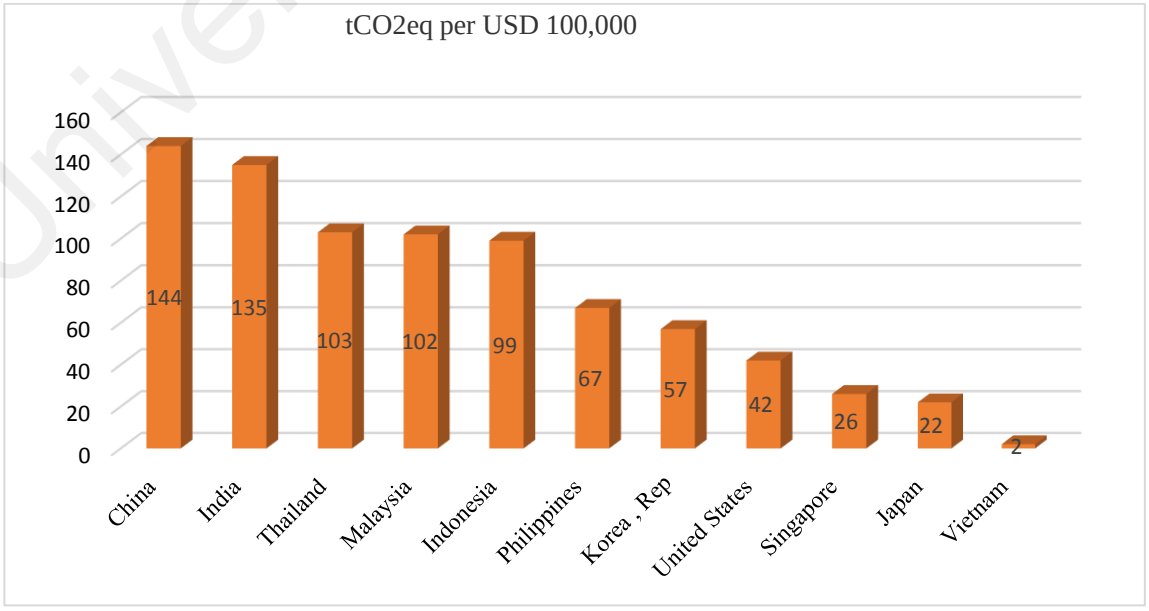

Figure 1.3: GHG emissions intensity of GDP
Source: World Resources Institut

The rate of increase in carbon emissions in Malaysia is also one of the highest in the world: Malaysia ranks third-highest worldwide, with an average annual growth of 4.7% from 1970 to 2008 (Klugman, 2011). In the BAU scenario, Malaysia's CO_2 emissions from fuel combustion are projected to increase by "3.0%, from 43.7 million tons of carbon equivalent (Mt-C) in 2007 to 86.0 Mt-C in 2030" (3rd ASEAN Energy Outlook, 2011).

The trends for total CO_2 emissions and GDP in Malaysia are presented in Figure 1.4. The figure shows that increases in total domestic output have always led to increased carbon emissions. Therefore, there is a positive relationship between increased GDP and carbon emissions in Malaysia.

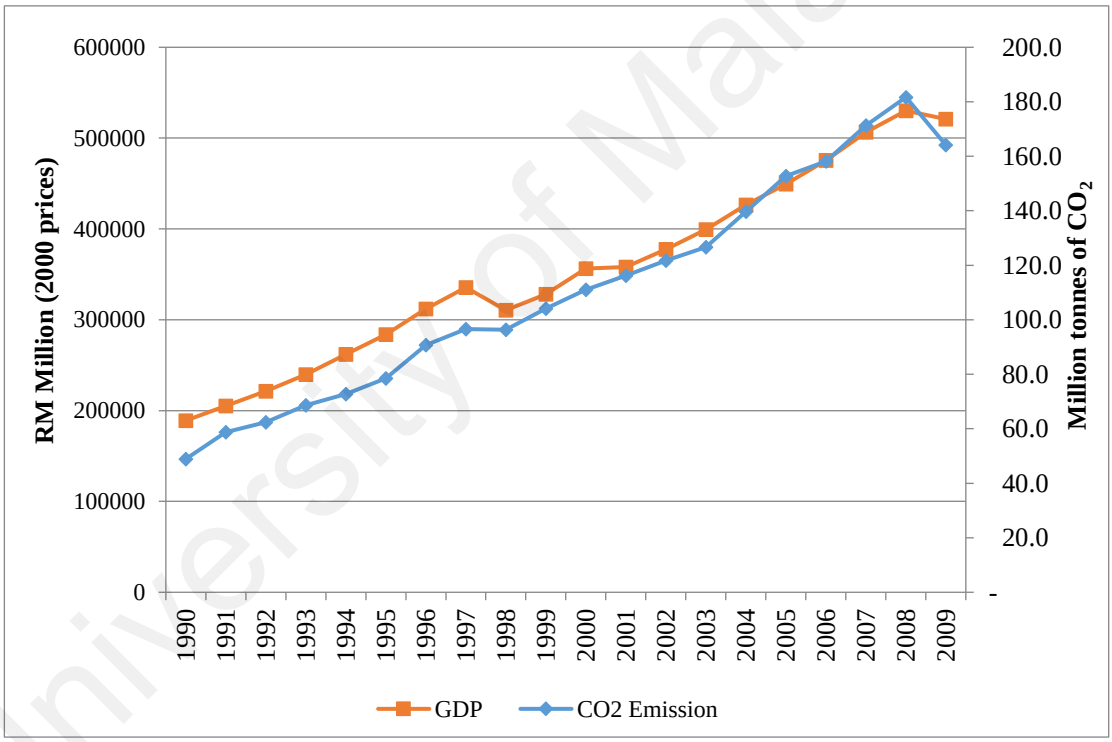

Figure 1.4: GDP and CO_2 emission trend in Malaysia
Source: NEB (2010)

Furthermore from Figure 1.4, it can be concluded that economic growth has led to an increase in air pollution. Malaysia, like other countries, depends heavily on non-renewable energy sources, which increase economic policymakers' concerns about the reserves of these resources and their global price fluctuations. To reduce the negative effects of oil price crises, a flexible and comprehensive plan for the economy is necessary.

Considering the impact of economic growth on energy consumption (Ong et al., 2011), meeting the ever-increasing demand for energy sustainably is essential to boosting the country's competitiveness and resilience in the 21st century (Zamzam Jaafar et al., 2003). Thus, the review reveals that a number of global crises, including crises in climate and fuel moving towards a green technology and applying a renewable energy policy are unavoidable.

Therefore, Malaysia must plan for the amount of energy that will be required in all sectors of the economy. It should also be noted that Malaysia has the highest renewable electricity potential compared to its share of the ASEAN population (Ölz & Beerepoot, 2010).

Government's concerns about fossil fuel depletion, adverse climate changes, and the necessity of developing renewable energy were displayed when Malaysia's former Prime Minister Mahathir Bin Mohamad claimed at the World Renewable Energy Congress in 1999 that, in the Malaysian context, "renewable energy could be justified based on the fundamental objectives of national energy policies, the main goal of which is to ensure the security and sustainability of the energy supply at a reasonable cost, and announced his plan to study the benefits of expanding our current four-fuel strategy by incorporating renewable energy as the fifth fuel." One year later, with the 'fifth fuel' policy made part of the Eighth Malaysian plan, renewable energy was added to Malaysia's energy policy.

Since 2000, the issue of renewable energy (RE) has received considerable critical attention from the government of Malaysia, followed by an increasing number and variety of RE policies and projects being implemented in the country. However, after 14 years, only 8% of the target and 0.19 of total generating capacity have been achieved.

1.3 Problem Statement

The Malaysian government has formulated a number of policies to meet the rising energy demand, especially by developing effective policies for RE. In Malaysia, as there

is a need to have an important policy to address the issue of fossil fuel depletion and adverse climate changes" (Maulud & Saidi, 2012), the 'fifth fuel' policy was launched in the Eight Plan (2001–2005), and the government set itself a target of obtaining 5% of its energy from renewable sources by 2005. However, this policy ended up reaching only 0.3% of the target by 2005 (Muhammad-Sukki et al., 2011). In the Ninth Malaysian Plan (2006–2010), the target of obtaining 5% of RE in the country's energy mix was again set. This goal was once again not achieved; so far, only 8.3% of the target has been reached (Maulud & Saidi, 2012).

After 10 years of implementing renewable energy policies, the share of renewable energy in Malaysia's total generated electricity is still less than 1% (EPU, 2010). It is evident that the RE policy implemented in the Eighth and Ninth Malaysian plans did not meet their targets. Furthermore, failure to achieve the targets from 2000 to 2010 was clearly declared in the Tenth Malaysian Plan, which indicated that "Malaysia is blessed with multiple RE resources, such as biomass, biogas, and solar, that will be leveraged to ensure a more sustainable energy supply. However, despite rigorous initiatives, the renewable target set out under the Ninth Plan period was not achieved" (Hashim, 2011).

As reported by Second National Communication to the UNFCCC, 2010, over the 10 years (2000-2010), forty millions U$ has been allocated for RE research and development to universities, research institutes, and industries focusing on developing technologies.

In the Tenth Malaysian plan (2011–2015), the government again aimed to achieve a renewable energy target of 985 MW by 2015, or 5.5% of Malaysia's total electricity generation mix. However, according to the Eleventh Malaysian Plan, RE installed capacity was 243 MW in 2014. Although the rate of success of the renewable energy policy during the Tenth Malaysian Plan was much better than of previous plans, only 24% of the target was achieved. This situation poses a serious question regarding what factors

influence renewable energy acceptance and prevent the full potential of renewable energy technology from being reached.

Although, in some cases, the elements affect RE acceptance are similar in industrialized and developing countries, specific national characteristics play an important role in determining the factors within each country (Wilkins, 2010). To identify barriers to the penetration of renewable energy in Malaysia, it is crucial to take into consideration the local characteristics affecting renewable energy development. Identifying and addressing the factors facing renewable energy technology acceptance is indispensable because learning from past experiences is a fundamental necessity for promoting the development of renewable energy. Hence, renewable energy development remains a concern of the Malaysian government. For example, the National RE Policy launched in 2010 aims for 11% of total energy to be from renewable sources (2080 MW) by 2020.

One major issue in renewable energy acceptance is public awareness on climate change and of RE use (Alam et al., 2014). It is therefore important to identify the factors that influence Malaysian residents' acceptance and use of renewable energy and determine the level of public awareness on climate change and RE technology.

Moreover, the government is committed in reducing carbon emissions following the Copenhagen Accord. Malaysia wants to achieve 40% carbon intensity reduction from the 2005 level by 2020. Since RE sources have a strong potential to displace emissions of greenhouse gases from the combustion of fossil fuels and thereby mitigate climate change, one proposed policy for mitigating greenhouse gas emissions is developing renewable energy technology. If the current RE policies are to be successful and overcome the barriers to the development of renewable energy, it is necessary to learn from previous experiences. There is a lack of understanding about the public's intention

to use green technology and renewable energy. Given that Technology Acceptance Model (TAM) is the most widely used model to explain the factors that promote or hinder the acceptance of a new technology (here RE technology), therefore, to better understand the acceptance of RE technology, RE acceptance model within the framework of TAM and in the context of Peninsular Malaysia is extended in this thesis. This study analyses the impact of public perception on the renewable energy sector. The overall purpose of this study is to determine the public awareness of climate change and perceptions of using renewable energy in the field of green technology and identify the factors that influence those perceptions. The study also explores the underlying factors that may be responsible for the acceptance of renewable energy in Malaysia.

This study develops a technology acceptance model that focuses on the acceptance and usage of renewable energy technology in Peninsular Malaysia in order to investigate the effect of perceived usefulness (PU) and perceived ease of use (PEOU) on renewable energy use, as this association is important for the development of renewable energy.

Furthermore, this thesis investigates the effect of the cost of renewable energy and people's knowledge of renewable energy on perceived usefulness and perceived ease of use, as this association is important in public perceptions of renewable energy.

1.4 Research Questions

The research questions of this study are as follows:

1- What is the level of public awareness of global climate change and renewable energy technology in Peninsular Malaysia?
2. What is the significant influence of cost and knowledge on acceptance of renewable energy in Peninsular Malaysia?
3. Do perceived usefulness and ease of use influence attitudes toward using renewable energy?

4. What factors affect user acceptance of renewable energy technology in Peninsular Malaysia?

1.5 Research Objectives

This study evaluates the impact of public perceptions (perceived usefulness and perceived ease of use) of renewable energy, on its use. Specifically, it attempts to

1. Determine the level of public awareness on the issue of global climate change and the use of renewable energy technology in Peninsular Malaysia.
2. Evaluate the impact of perceived of usefulness and perceived ease of use on the renewable energy acceptance in Peninsular Malaysia.
3. Evaluate the impact of cost and knowledge on the renewable energy acceptance in Peninsular Malaysia.
4. To test the proposed research model (RE acceptance) in a Peninsular Malaysia context.

The last three objectives are conceptualised into testable hypotheses.

1.6 Statement of Significance

Previous studies have not dealt with the conceptual framework for RE technology acceptance in Peninsular Malaysia. In response, this dissertation seeks to extend the knowledge of both TAM theory and practice in the field of renewable energy. In addition, this research sheds new light on developing RE policy in Malaysia especially peninsular Malaysia (west Malaysia) by investigating the association between cost and knowledge, perceived usefulness, and perceived ease of use, and attitude towards the usage of renewable energy in Peninsular Malaysia.

Importantly, this research will be a milestone for different stakeholders, policymakers, and decision makers who are or will be interested in developing renewable energy technologies in Malaysia. Other than that, this study will provide them with a complete feasibility assessment of public perceptions of green technology and renewable

energy. This study could also be useful in painting a clear picture of people's thoughts on climate change and renewable energy and its application towards sustainable living.

The widespread use of renewable energy is believed to reduce the use of non-renewable energy resources while maintaining economic growth. Thus, this study is significant in raising public awareness of the importance of renewable energy technology as an important part of tackling global climate change and improving the efficiency of energy use in Malaysia.

1.7 Research Method and Analysis

To successfully deal with research investigation, test the hypothesis, and address the research objective, both quantitative and qualitative methods were applied. For quantitative testing, primary data were extracted from a nationally representative quota sample of Peninsular Malaysian citizens aged 20 and over with higher education qualifications; 21.75% of the population in this area (4,893,086) was interviewed face-to-face. Probability sampling and a stratified cluster technique were employed to collect data. The samples for this study were collected from four regions (the north, south, east coast, and central regions) in Peninsular Malaysia; the stratified cluster technique is an appropriate method in this case. Using a questionnaire, the data for this study were gathered using the face-to-face interview method.

The probability stratified cluster sampling method was used in this study owing to the cost and convenience of obtaining adequate respondents. To conduct the survey, local cities were first identified. Second, to obtain a nationally representative quota sample, a total sample size of 784 was used (according to the Cochran formula). Third, the sampled elements were allocated across the four regions of Peninsular Malaysia (north, central, east coast, and south), thus allowing an adequate proportion of the total elements sampled for each region to be selected (north region, 23%; central region, 28%; south region, 27%; east coast region, 22%).

The analysis of the data was conducted by using SPSS (Statistical Package for the Social Sciences) and performing structural equation modelling (SEM).

To gain insight into the research questions and objectives, this study used qualitative research as well. "The qualitative method lets the investigators to achieve deep understanding about a given phenomenon and develop a highly descriptive comprehension of the subject under study" (Yin, 1994, p. 36). After collecting data from the survey, a series of semi-structured interviews were conducted with 35 energy experts, including 18 academics, and 17 members of energy companies and civil society.

As the main data collection method for the qualitative part of this study was the interview, the researcher had an obligation to respect the rights, needs, values, and desires of the interviewees.

1.8. Research Boundaries

The area of interest in this study is an acceptance of renewable energy technology. Moreover, the investigation of RE acceptance is limited to the Peninsular Malaysian perspective). Finally, as mentioned, data were collected from a study that focused on a specific group (Peninsular Malaysian citizens aged 20 years and over with higher education). It is important to note that one of the basic strategic focuses of RE technology (in the Tenth Malaysia Plan) is to increase the awareness and acceptance of the general public by reviewing the practice of green technologies through advocacy programmes. In this regard, information about the level of public awareness of the use and importance of green technologies can assist the government and policymakers in designing a more comprehensive and effective awareness programme.

1.9. Thesis structure

The overall outline and organisational pattern of this thesis is discussed below. The thesis comprises of seven chapters. Chapter one introduces research background, research objectives and other issues which are related to topic under study. Chapter two critically

reviews the relevant literature related in this investigation, followed by chapter three, which discusses about the conceptual framework that is used in this study.

The methods used in this investigation chapter are described and discussed in chapter four. Results and findings of this thesis are presented in chapter five, while the findings which emerged from the statistical analysis are discussed in chapter six, alongside the finding of the qualitative study. Finally, chapter seven presents theoretical and managerial implications, policy recommendation, limitations and directions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This review of the extant literature is designed to explore the theoretical foundations underpinning green technology and renewable energy policy studies, especially in the Malaysian context. This attempt also significantly consolidates energy policy in Malaysia, which is divided into five phases: the necessity of RE policy and potential in Malaysia, the impact of public opinion on renewable energy policy, the role of local knowledge in environmental issues, research gaps in the literature related to RE policy, and green technology acceptance in Malaysia. This review is organized into seven sections. Section 2.2 discusses climate change in Malaysia. The next section present an overview of green technology, followed by the forth section describing RE as an option for moving towards GT. Section 2.5 describes the importance of public awareness about climate change. Climate change is discussed in 2.6 and green technology in the context of Malaysia is presented in 2.7. The history of energy policy in Malaysia is discussed in 2.8.The necessity of RE and literature about RE situation in Malaysia is presented in section (2.9). Next, section (2.10) give a brief overview of technology acceptance model (TAM) and then the section (2.11) explains the applicability of TAM in green filed of energy. Research gap is deliberated in section (2.12) and the final section is conclusion.

2.2 Climate Change as a Universal Concern

The observational evidence, including increases in average global air temperatures, melting snow and ice, increasing average global sea levels, changes in Arctic temperatures and ice, changes in precipitation, ocean salinity, heat waves, and the intensity of tropical cyclones, show that the climate system is becoming warmer (IPCC, 2007). According to the IPCC (2014, p. 26), “each of the last three decades has been successively warmer at the Earth’s surface than any preceding decade since 1850. The

period from 1983 to 2012 was likely the warmest 30-year period of the last 1400 years". It seems that the global climate change impacts are unavoidable. The Intergovernmental Panel on Climate Change (IPCC) forecasts that the ground temperature will increase roughly 1 to 6 ◦C from 1990 to 2100 due to the critical weather variability and extreme events.

Thus, it is a widely held view that carbon dioxide (CO_2) concentrations have been increasing significantly in the atmosphere over the past century compared to the pre-industrial era (about 280 parts per million, or ppm) (IEA, 2015).

The major source of this climatic change is human activities, particularly those involving combustion of fossil fuels and biomass burning. This kind of activity produces GHG, especially CO_2, which affects the composition of the atmosphere and leads to the depletion of the stratospheric ozone layer (IPCC, 2001). Although emissions of CO_2 come from a number of sources, the main source is the combustion of fossil fuel in the power generation, industrial, residential, and transportation sectors (IPCC, 2005). Besides, human influence on the climate system is clear (IPCC, 2013).

Among many human activities that produce greenhouse gases, the use of energy represents by far the largest source of emissions. As shown in Figure 2.1, CO_2 emissions from fossil fuel combustion have risen significantly since 1870 (IPCC, 2013).

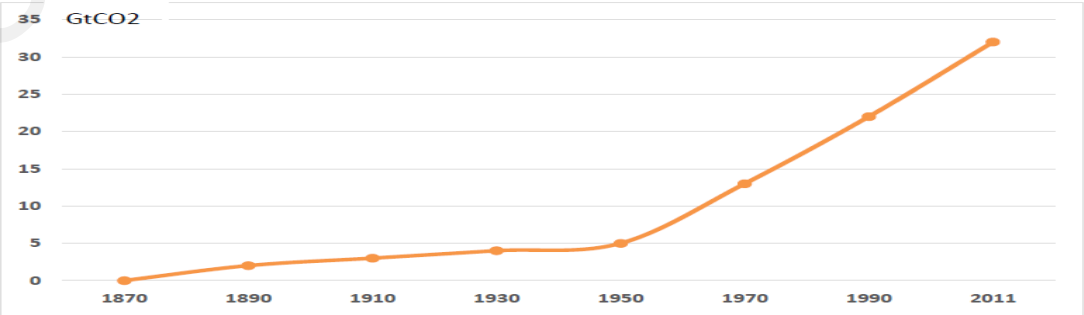

Figure 2.1: Trend in CO2 emissions from fossil fuel combustion
Source: IPCC (2013)

According to IEA (2015), in 2013, CO2 emissions reached around 32 GtCO2, an increase of 2.2% over 2012 levels. Meanwhile, moving towards a green technology and developing renewable energy technology are among the various important options for lowering Greenhouse Gas emissions for the energy system. IPCC (Intergovernmental Panel on Climate Change) (2014) indicated that "RE may, if implemented properly, contribute to social and economic development, energy access, a secure energy supply, and reduce negative impacts on the environment and health. For any given long-term GHG concentration goal, the scenarios exhibit a wide range of RE deployment levels. "To achieve a green energy revolution and large-scale CO_2 emission reductions, green technology options will be needed (OECD, 2013).Therefore, the best way to afford the energy requirements for the development process is expanding RE sources.

2.3 Green technology

Many countries will face higher risk if they fail to formulate and implement policies and programmes to address the various effects resulting from changes in climate (Agrawal and Franhsuer, 2008). A number of recent studies discusses the issue of climate change and highlights the need to formulate policies to address it (Rowhani et al., 2011; Georgescu et al and IPCC (2007).

The term 'green technology' has come to be used to refer to a policy or application which is adopted by various countries to address the issues of energy and climate change simultaneously. "The distinguishing feature of a "green" technology is that it generates or facilitates a reduction in environmental externalities relative to the status quo" (Allan et al., 2014, p. 2).

The term 'green technology' (GT) is "broadly used for more environmentally friendly solutions. Furthermore, it can be used as an environmental healing technology that reduces environmental damage caused by products and technologies used for

convenience. For instance, green technology is a technology that allows people to progress more rapidly, but at the same time minimises the negative impact to the environment. Various governments have embarked on a number of initiatives to change that in which green technology has been given a control role" (Billets, 1997, p.98).

In addition, "green technology is an initiative involving various kinds of methodologies and material enhancement, from techniques for generating energy to non-toxic cleaning products. Many scientific studies on green technology pointing to global warming and climate change are caused by greenhouse gases, and address needed energy" (Bakar et al., 2011, p.123).

A generally accepted definition of green technology is lacking. The term can be broadly defined as "technology that has the potential to significantly improve environmental performance relative to other technologies" (Low Carbon Green Growth Roadmap for Asia and the Pacific, 2010, p.9).

Green technology covers a broad range of production and consumption technologies including renewable energy technology and efficiency technology (United Nations Environment Programme, Environmentally, 2003).

Other than that, the adoption of new, cleaner technologies is essential in reducing pollution and providing sustainable energy. Even for technologies that have already been developed, the empirical technology diffusion literature has demonstrated that the diffusion of new technologies can be slow (Mahajan, Muller & Bass, 1990).

2.4 Renewable Energy an Option for Moving Towards Green Technology

"It is well-known that eight countries have 81% of the world's crude oil reserves, six countries have 70% of all natural gas reserves, and eight countries have 89% of all coal reserves. More than half of Asia, Africa, and Latin America import over half of all their commercial energy" (Stambouli & Traversa 2002, p.298).

The number of world population is projected to having the excess of 12 billion by 2060 (Sayigh, 1999). On the other hand, the global primary energy demand is expected to continue growing. The International Energy Agency (IEA) projects a growth rate of 1.4% year up to 2035 (see Table 2.1).

Table 2.1: Primary energy demand by region in the IEA current policies scenario,

	Total energy demand [Mtoe]		Growth rate 2008-2035[a] [%]	Share in total Energy demand [percent]	
	2008	2035		2008	2035
OECD	5421	5877	0.3	44.2	**32.6**
Non- OECD	6516	11,696	2.2	53.2	**64.8**
Europe/Eurasia	1151	1470	0.9	9.4	**8.1**
Asia	3545	7240	2.7	28.9	**40.1**
China	2131	4215	2.6	17.4	**23.4**
India	620	1535	3.4	5.1	**8.5**
Middle East	596	1124	2.4	4.9	**6.2**
Africa	655	948	1.4	5.3	**5.3**
Latin America	569	914	1.8	4.6	**5.1**

Source: IEA (2010)

Moving towards green technology and renewable energy is thus unavoidable, as greening the energy sector aims at a renewable and sustainable energy systems. The most direct approach is to reduce the use of fossil fuels– an energy source whose combustion accounts for two-thirds of all GHG emissions by moving towards renewable energy (IPCC, 2007).

It is necessary here to clarify exactly what is meant by renewable energy. "Renewable energy is any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. Moreover, RE is obtained from the continuing or repetitive flows of energy occurring in the natural environment and includes resources such as biomass, solar energy, geothermal heat, hydropower, tide and waves and ocean thermal energy, and wind energy" (IPCC, 2011).

Nonetheless, it should be noted that the investment of RE has been increasing rapidly in recent years. (See Figure 2.2)

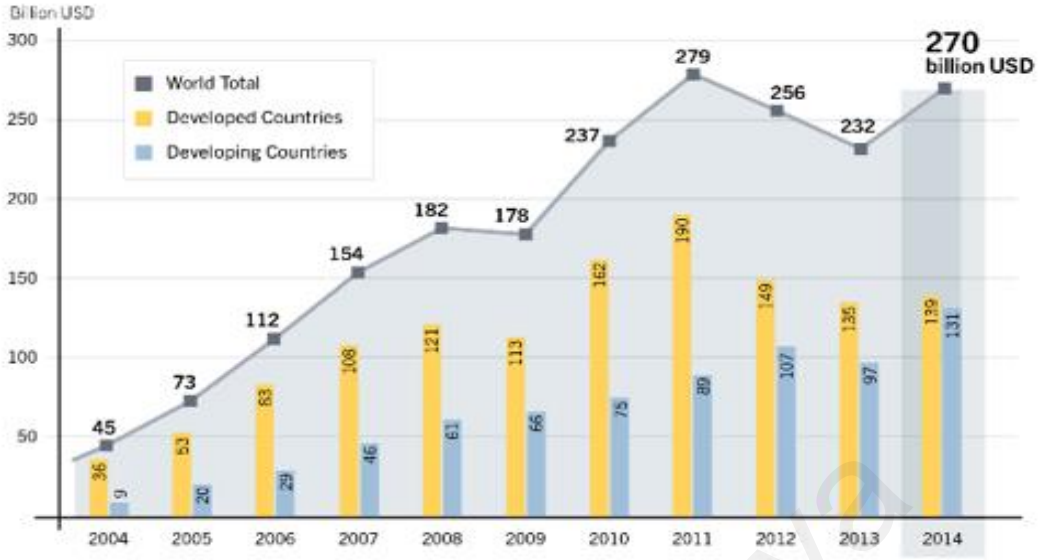

Figure 2.2: Global investment in RE, 2004 -2014
Source: REN 21

As declared by IPCC (2011), "Renewable energy can be integrated into all types of electricity systems, from large, interconnected continental-scale grids down to small autonomous buildings. RE offers the opportunity to contribute to social and economic development, energy access, energy security, and climate change mitigation and the reduction of environmental and health impacts. Countries at different levels of development have different incentives to advance RE" (p.57).

For example, providing access to energy and reducing the negative impact of fossil fuel can be considered the most likely reasons to adopt RE technologies in developing countries. This is evident in the case of increasing number and variety of RE policies in these countries (IPCC, 2014).

2.5 Public Awareness about Climate Change and Renewable Energy

At the beginning of the 21st century, the world faced severe climate disasters and diverse impacts of technology on ecology. Governments and the public around the world began paying more attention to climate change issues and developing green technologies such as renewable energy. To obtain the public's trust and enhance the legitimacy of their

decision making, governments must include public opinion and communication in policy processes and decisions (Chou, 2013).

The determinants of public opinion and support for climate change policies and renewable energy resource use have received significant scholarly attention in the literature on both the public perception and economics of climate change. Public support is one of the key factors that determine the desirability of a climate change mitigation policy in democratic countries (Akter et al., 2012).

The importance of public opinion in addressing environmental issues like global warming and developing renewable energy technologies has been highlighted by several researchers (Krosnick,2006; Lorenzoni & Pidgeon, 2006; Sterman & Sweeney, 2007).

Public opinion and attitudes are critically important to these challenges. Spence and Pidgeon (2009) pointed out that popular opinion is a key element for taking action against climate change.

Stamm et al. (2000) reported that public understanding of global warming was a communication problem, as people had a limited understanding of the causes and consequences of and solutions for global warming. Wilson (2004) showed that the knowledgeability of people was crucial to adopting pro-environmental behavior. Krosnick et al. (2006) found that 'seriousness' judgments about global warming were influenced by beliefs about the existence of global warming, human responsibility for causing global warming; and their ability to reduce it. According to Lorenzoni and Pidgeon (2006), people will support GHG mitigation initiatives if they do not require a significant alteration of lifestyle, understand the scientific basis for such programs, and consider the issue a very serious societal or ecological problem or one that affects them personally. Sterman and Sweeney (2007) indicated that consumer behavior and other

activities affecting people's daily lives must be taken into consideration in approaches to global warming.

Several studies have investigated public awareness and concerns about global climate change in different countries. In Germany, it has been reported that majority of public (64%) were concerned about climate change (Lo schel et al., 2010).

A seminal study in this area is the survey in India which is indicated that more than half of respondents (57%) had 'heard about' climate change. Similarly, in Australia, it is reported that around 80% of public think that climate change is human induced (Jackman, 2009).

However, 67% of respondents refused to pay for climate change mitigation (Akter and Bennett, 2011). In the same vein, Brechin (2003) found that majority of public in US opposed energy policy such as energy taxes.

Meanwhile in another study, Lorenzoni and Pidgeon (2006) argued that average Europeans' belief on the issue of climate change is nothing unlike from that of citizens in other industrialised nations. Therefore, it is important to note that the involvement of human activity in the climate change issue is highlighted by several studies (Brechin, 2003; Leiserowitz, 2005).

Moreover, the literature has also emphasised the importance of public opinion of renewable energy technologies. For instance, Ribeiro et al. (2014) conducted a survey in Portugal aiming to study the Portuguese's public awareness of renewable energy technologies.

Also, there was a generally positive attitude towards new renewable energy projects, and this tendency was most pronounced for solar power; the least pronounced was new hydro power plants, but they still had considerable support.

2.6 Climate Change in Malaysia

Climate change is one of the most significant challenges faced by Southeast Asia in the 21st century. Southeast Asia includes the 11 members of the Association of Southeast Asian Nations (ASEAN): Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, Vietnam, and new member Timor-Leste.

All these countries in the Southeast Asia region experienced increased CO_2 emissions from 1971 to 2013. Indonesia, Thailand, and Malaysia collectively accounted for 80% of this increase, while accounting for 55% and 65% of growth in population and GDP, respectively (Sandu et al., 2011).

Among the South East Asian countries, with about 0.4% of the world's population, Malaysia's 27 million people accounted for 5.5% of global carbon emissions (UNDP Human Development Report 2011, 2012) .

Malaysia's annual average GHG emissions were found to be much higher than the global average increase from 1990 to 2005. Moreover, Malaysia's emissions of CO_2 per capita, about 7.7 tonnes, were higher than the Asia-Pacific average of 2.6 tonnes, based on the National Communications Report submitted by each country to the UNFCCC (OECD, 2010). Malaysia is also producing the highest CO_2 and GHG emissions per capita among ASEAN countries (Sarkar et al, 2013).

The rate of increase in carbon emissions in Malaysia is also one of the highest in the world: Malaysia ranks third-highest worldwide, with an average annual growth of 4.7% from 1970 to 2008 (Klugman, 2011).

In terms of the BAU scenario (i.e. the continuation of the current trend) projects that are without additional mitigation measures, which 285.73 million tonnes of CO_2 will be released in Malaysia in 2020, a 68.86% increase over the amount of CO_2 was emitted in 2000 (Safaai et al., 2011).

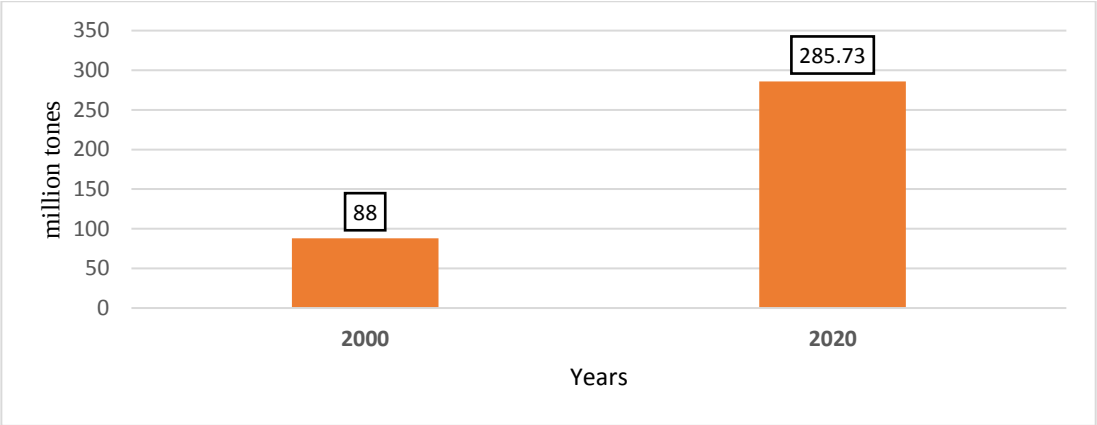

Figure 2.3: CO2 emissions in Malaysia, 2000 and 2020
Source: Safaai et al (2011)

The trends in total CO_2 emissions and GDP in Malaysia are presented in Figure 2.3. This figure shows that the increase in total domestic output is correlated with an increase in carbon emissions. High GDP can result in greater depletion of good and services. Figure 2.4 follows to show that there is a direct relationship between Co2 emissions and GDP growth. This also means that the movement in CO_2 emissions can lead to the movement in energy demand as well.

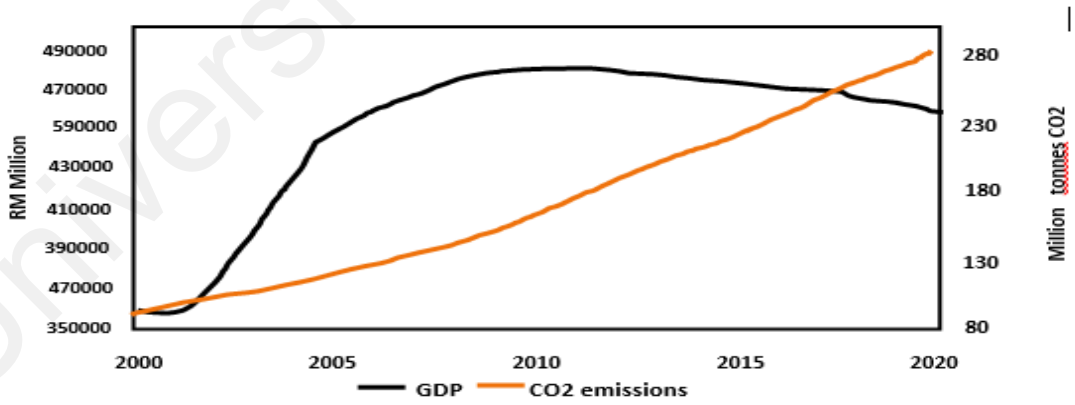

Figure2.4: Relationship between GDP and co2 EMMISIONS in Malaysia, source: Malaysia Energy Information Hub, 2015

Figures 2.5 show that there is direct relationship between population and emissions and both of them have increased over the last 15 years in which we have the same trend in the future.

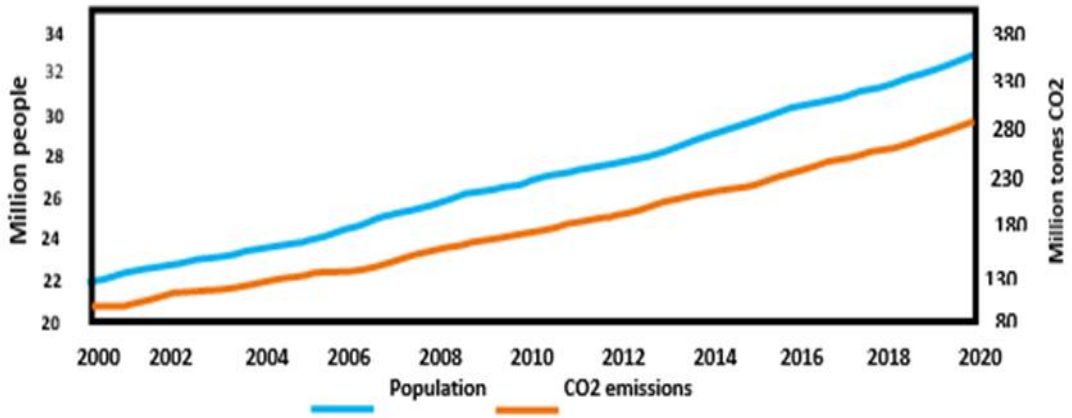

Figure 2.5: Relationship between population and CO 2 emissions in Malaysia, Source: Malaysia Energy Information Hub, 2015

It is worth mentioning that, according to the Climate Change Performance Index (CCPI 2015), an innovative instrument that brings more transparency to international climate politics, Malaysia ranks 52 out of 61 countries. On the basis of standardized criteria, the CCPI evaluates and compares the climate protection performance of the countries responsible for more than 90% of global energy-related CO_2 emissions. Based on this report, among 15 newly industrialized countries, Malaysia and Chinese Taipei have the worst performance (see Table 2.2).

Table 2.2: CCPI for newly industrial countries

Rank	Country	Score	Rank	Country	Score	Rank	Country	Score
9	Morocco	65.73	37	South Africa	54.63	49	Brazil	**48.51**
18	Mexico	61.30	39	Algeria	54.46	50	Singapore	**47.27**
23	Indonesia	59.57	45	China	51.77	51	Turkey	**46.95**
24	Egypt	59.19	47	Thailand	50.61	52	**Malaysia**	**46.84**
31	India	56.67	48	Argentina	49.61	54	Chinese taipei	**45.03**

Source: CCPI 2015

In summary, it can be seen that, a number of researchers have reported public awareness in various countries. However, little is known about public awareness and

concerns about climate change in Malaysia. This indicates a need to understand the various perceptions about climate change in Malaysia.

2.7 Green Technology in Malaysia

The Malaysian government has been embarking on a number of initiatives to change that in which green technology has been given a control role. According to the Ministry of Energy, Green Technology and Water Malaysia (KeTTHA), green technology refers to the "development and application of products, equipment and systems used to conserve the natural environment and resources and satisfy the following criteria: It minimises the degradation of the environment, was zero or low greenhouse gas (GHG) emission is safe for use and promotes healthy and improved environment for all forms of life.

Furthermore, it conserves the use of energy and natural resources it promotes the use of renewable resources" (KeTTHA, 2010). In Malaysia, a green technology policy was launched in 2009 with five objectives: "(i) minimising growth in energy consumption while enhancing economic development; (ii) facilitating the growth of the GT industry and enhancing its contribution to the national economy; (iii) increasing national capability and capacity for innovation in GT development and enhancing Malaysia's competitiveness in GT in the global arena; (iv) ensuring sustainable development and conserving the environment for future generations; and (v) enhancing public education and awareness of GT and encouraging its widespread use" (NST, 2009).

Chua and Oh (2011) explained that the development of green technology in Malaysia is overseen by four government bodies: the Ministry of Energy, Green Technology and Water, established in April 2009; the Malaysia Energy Centre (MEC), established in 1997; the Malaysia Green Building Confederation (MGBC), registered in 2009; and the Green Technology Council (GTC), founded in 2009. The Green Technology Financing

Scheme (GTFS) was announced in the 2010 national budget to support GT and green buildings.

The establishment of the Green Technology Financing Scheme (GTFS), amounting to RM 1.5 billion in the 2010 budget, was intended to provide soft loans to companies that supply and utilise this technology (Bakar et al., 2011)**.** Under the Tenth Malaysian Plan, all new government buildings will be designed to meet green standards. Thus, Malaysia's green technology revolves around renewable energy.

2.8 Energy Policy in Malaysia

"Malaysia's equatorial climate has year-round average temperatures of 20 to 35°C and a relative humidity of 80 to 90%. This indicates that the timing of the rainy season on the peninsular coast varies" (APEC, 2009, p17).

Since attaining independence in 1963, Malaysia has been moving towards becoming industrialised and its energy sector plays a considerable role in the economy. For instance, the country has extensively implemented energy conservation in order to reduce the consumption growth rate (Shekarchian, et al, 2011).

Energy policy in Malaysia is regularly revised to meet the country's energy demands. The section below presents an overview of energy policies according to the development context by period as outlined in Figure 2.7. The division of the periods is based on major variations in the development approaches; this occurs in four main stages, distinguished by economic transformations.

2.8.1 The first phase, 1957–1970: independence, extending power network

When Malaysia attained independence in 1957, the economy was fundamentally primary with heavy dependence on rubber and tin. The government of the newly independent nation sought to immediately address the structural weaknesses of the economy by focusing on diversifying and modernizing agricultural production, to

stimulate new kinds of economic activity, to progress in health and social welfare, to emphasize rural development, to progress in manufacturing, and to develop utilities and energy sectors.

In this period, the government understood that economic and social development is highly dependent on the availability of energy and a strong power sector.

Thus in the First Malaysian Plan (1966–1970), establishing extensive and efficient electricity and water supply systems were the main concerns of the government. There was a rapid growth in power generation capacity under the First Malaysian Plan, as several major projects were completed.

Other than that, the government also recognized that 'electricity contributes towards improved living standard in rural areas 'Through the electrification programme under the FMP, nearly 650 villages were covered at a total cost of $23 million, and more than 50,000 rural households were provided with electricity (EPU, 1966).

2.8.2 The Second Phase, 1971–1980: New economic policy, first energy policy

The period from 1970 to 1980 saw the New Economic Policy (NEP) introduced in the Second Malaysia Plan (1971–1975). The government attempted to induce industries to locate in selected development areas because of the attention being given to the power supply development and the energy sector. In 1974, as the first policy to significantly impact the industry, the Petroleum Development Act was formulated, investing PETRONAS, with the exclusive rights to explore, develop, and produce petroleum resources in Malaysia. The was the first policy to significantly impact the industry (Oh, Pang, & Chua, 2010). In 1976, the Third Malaysian Plan (1976–1980) was launched, in which the overall philosophy of this policy was aimed at keeping a balance between development and environmental conservation (Hezri, Nordin Hasan, 2006).

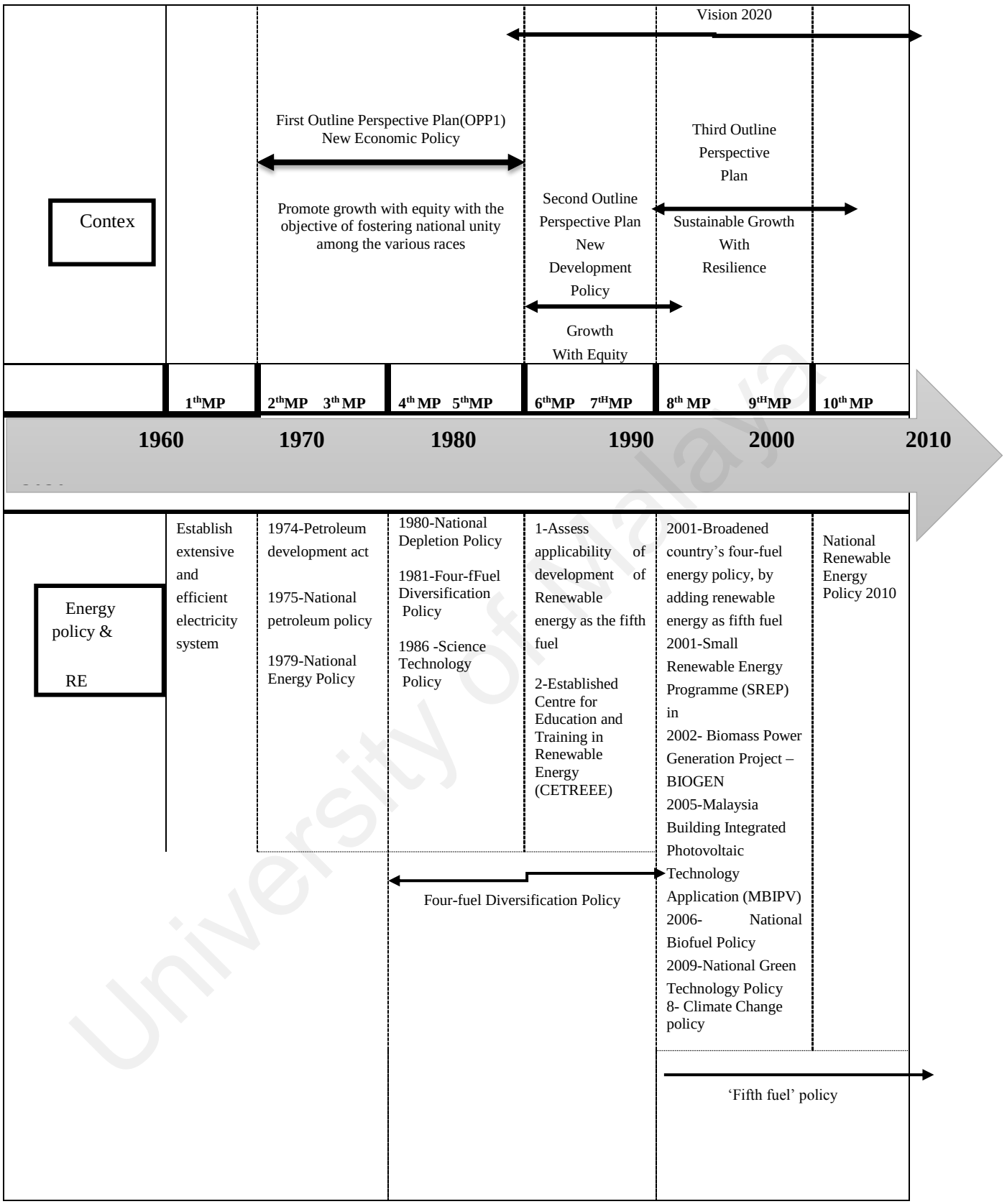

Figure 2.7: Historical overview of energy-related policy in Malaysia

Appropriate measures were taken to ensure that the development of power supply was adequate to meet the projected demands of industry, commerce, and domestic

consumption. The feasibility of utilising nuclear energy was also considered (EPU, 1976). In 1975, the National Petroleum Policy was developed to regulate the oil and gas industries in Malaysia order to achieve the overall economic development requirements in the country.

The most significant energy policy, the National Energy Policy, was launched in 1979 and it identified the following major objectives: "(i) to ensure the adequacy, security, and cost-effectiveness of the energy supply; (ii) to promote efficient utilization of energy; (iii) to discourage wasteful patterns of energy consumption; and (iv) to minimize any negative environmental impacts in the energy supply chain" (Othman al, 2009).

The initiative continued when in 1980, "the National Depletion Policy (NDP) was incorporated into the National Petroleum Policy (NPP) to regulate the production of major oil fields and preserve oil and natural gas field development. As a result, oil production was restricted to 650,000 barrels per day" (NEDO, 2004, p.91).

2.8.3 The Third Phase, 1980 –1990: Structural transformation, four-fuel strategy

Amid the economic crisis of the early 1980s, the decade witnessed a major structural transformation of the economy into more advanced industries. This phase included the Fourth and Fifth Malaysian Plans. 'In view of the increasing cost of fuel since 1973,' says the Fourth plan (1981–1985), "high priority is given to finding alternative sources of energy and the formulation of comprehensive energy policy".

The need to identify all available energy resources in the country had become urgent. During the FMP, the main targets of the energy sector were to reduce the country's overdependence on petroleum for electricity generation by utilizing other alternative sources such as hydro power and gas, as well as to increase the coverage of electricity supply to rural households (EPU, 1981).

In 1981, the government applied the Four Fuel Strategy to the NDP to "reduce the country's overdependence on oil (especially thermal power generation) and find the best balance among four types of energy sources: oil, natural gas, hydropower and coal" (NDEO, 2004). Its aim was to ensure the reliability and security of the energy supply through a mix of oil, gas, hydro and coal sources. Hence, in the Fifth Malaysian Plan (1986–1990), significant progress had been made in supplying energy input to support the nation's economic development. As a result of these diversification programmes, the success of fuel switching was remarkable in electricity generation.

The over reliance on oil was reduced tremendously, from 67% in 1985 to 42% in 1990, as shown in Chart 11-1. By contrast, the share of gas increased markedly from 9% to 24%. Coal, which became a source of electricity generation in 1988, accounted for 16% of the generation mix in 1990. During the Fifth Malaysia Plan period (1991–1995), a major development in energy was the attainment of a rapid diversification in the supply of and demand for the nation's energy resources (EPU, 1991). Figure 2.8 illustrates the success of the Four-fuel Diversification Policy, whereby the share of fuel oil in electricity generation decreased while the share of natural gas increased.

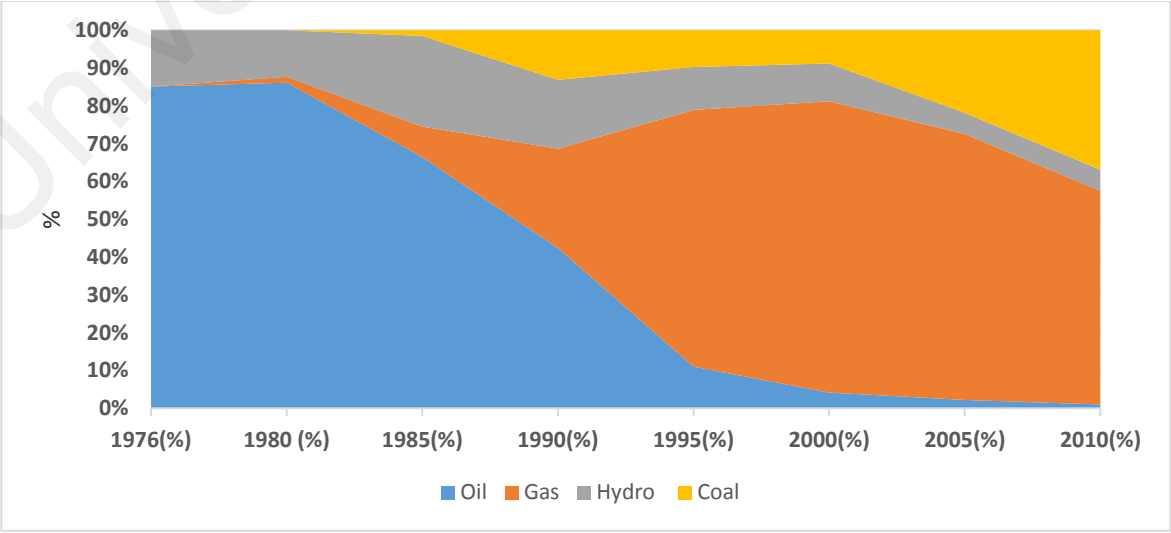

Figure 2.8: Energy Mix in Malaysia 1976–2010
Source: APEC energy statistics (2009 & 2010)

2.8.4 The Fourth Phase, 1990–2000: prosperity and adversity

The year 1990 began with the declaration of Vision 2020, which envisages Malaysia as a developed and industrialized country by 2020. The vision also heralds the beginning of the National Development Policy (NDP). The policy, built on the preceding New Economic Policy (NEP), has 'balanced development' within the framework of rapid growth with equity as its primary thrust. This period was covered by the Sixth and Seventh Malaysia Plans.

During the Sixth Plan period, the focus of the energy sector was to ensure adequate and reliable supplies of energy as well as to utilize resources efficiently while being cognizant of environmental considerations. The nation's strategic move to reduce dependence on oil as an energy resource resulted in the rapid development of environment-friendly natural gas. In addition, the period witnessed the restructuring of the electrical supply sector with the licensing of seven IPPs to generate electricity. At the same time, initial efforts were taken to conserve the nation's energy resources through the development and promotion of efficient systems, processes, equipment, and buildings (EPU, 1996).

"Sustainable development of energy resources was undertaken during the Seventh Plan period. A holistic approach was adopted in promoting the utilization of renewable resources such as biomass, biogas, and municipal waste, solar, and mini hydro. A project for the development of a strategy for renewable energy as the fifth fuel was undertaken to assess the RE potential in the country and consider the legal, regulatory, and financial framework needed to encourage the utilization of renewable resources" (EPU, 2001).Other emphasis in the Seventh plan include "sustainable development of deployable resources and the diversification of energy resources, ensuring the adequacy of generating efficiency and expanding and upgrading the transmission and distribution

infrastructures, and encouraging the use of new and alternative energy sources as well as the efficient utilization of energy" (Hashim & Ho, 2011).

2.8.5 The Fifth Phase: Towards competitiveness and developing RE policy

The 2000s started with the launch of the National Vision policy (NVP) as a framework for development. The NVP focused on sustainable growth with resilience and gave priority to providing energy services without environmental degradation and reducing materials, pollution, and the waste intensity of urban–industrial activity. It should be noted that in its path towards industrialization and high growth in GDP (See Table 2.3), Malaysia has faced an excessive consumption of energy, mainly fossil fuels.

Table 2.3: GDP growth in Malaysia

	1980	1990	1995	2000	2005	2010
GDP GROWTH RATE (%annually)	7.4	9.0	9.8	8.9	5.3	7.2

Source: World Bank

Final energy demand increased from 5.114 Ktoe in 1978 to 29.699 in 2000, an increase of approximately 600%. Figure 2.9 shows the trend in final energy demand from 1978 to 2010.

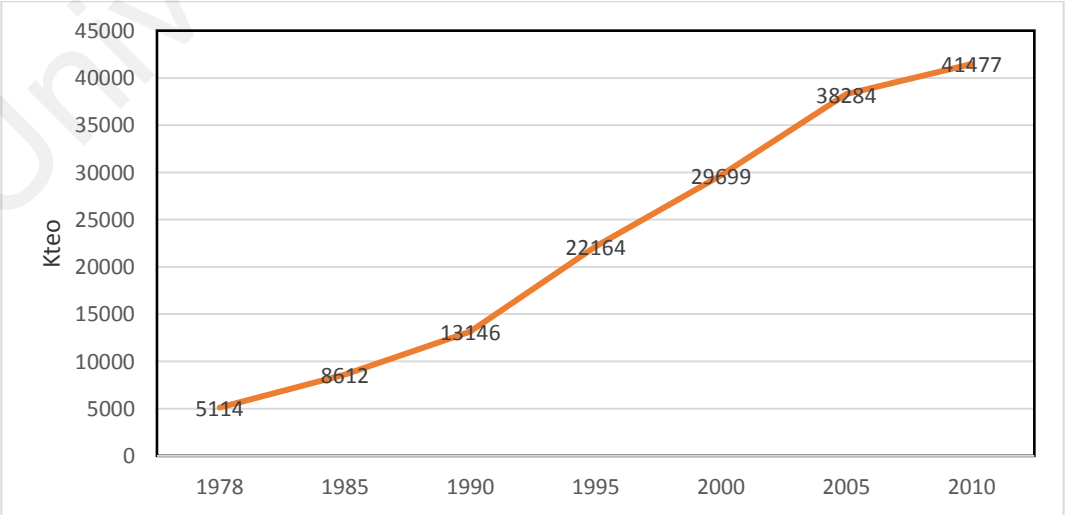

Figure 2.9: Energy demand in Malaysia, 1978–2010. Source: Malaysian Energy Information HUB

In this situation, where providing adequate and sustainable energy was of concern to the government of Malaysia, the Malaysian PM announced at 1999 World Renewable Energy Congress that Malaysia planned to expand its four-fuel strategy by incorporating renewable energy as the fifth fuel. One year later, the Eighth Malaysian Plan (2000–2005) broadened the country's four-fuel energy policy, which included oil, gas, coal, and hydro, by adding renewable energy as a fifth fuel. Under the Eighth and Ninth Malaysian Plans, the government has taken several steps to explore and promote the use of renewable energy as an alternative fuel source (Alam et al., 2014).

In an effort to promote the utilization of RE as a fifth fuel, the Small Renewable Energy Programme (SREP) was launched in 2001. The SREP attempted to install 500 MW of energy from 2001 to 2005 but ended up achieving only 12 MW (2.5%) of capacity by the end of 2005 (Sovacool et al., 2011). Other key emphases of the Eighth plan included supporting the development of industries producing energy-related products and services, providing incentives for EE and the use of RE resources, and maintaining the quality of the power supply (Muhammad et al, 2011).

In 2002, the BioGen project was introduced with the ultimate objective of promoting and demonstrating biomass and biogas grid-connected power generation projects and reducing the growth of GHG emissions from fossil fuel, by utilizing excess oil palm biomass residues (Hashim & Ho, 2011). The development and utilization of RE was further intensified in the Ninth Plan period**.** Under this plan, efforts continued to foster an environment more conducive to the implementation of SREP projects. The plan proposed achieving 350 MW of the country's energy from renewable resources by 2010.

Meanwhile, the Malaysia Building Integrated Photovoltaic Technology Application (MBIPV) was launched as well (Islam, 1970). Other programmes that were intensified

during the plan period included the development of bio-fuel using palm oil as a renewable source of energy.

This National Bio-fuel Policy aimed at reducing the country's fuel import bill, promoting demand for palm oil, and shoring up its price, especially during periods of low export demand (Rahim & Liwan, 2012). This policy is the government's effort to develop new RE, particularly biofuels, to overcome quickly depleting fossil fuels and the escalating price of petroleum (Lau, et al 2009).

As mentioned, the Ninth Malaysian Plan failed to achieve its renewable energy goals. For example, although Malaysian planners lowered the SREP target from 500 MW to 350 from 2005 to 2010, only 61 MW of capacity had been built (Mustapa et al., 2010).

Comparing total primary energy supply in 2000 and 2009 clearly illustrates that Malaysian dependency on fossil fuels had not changed and that the country has merely switched among different kinds. (See Table 2.4).

Table 2.4: Energy mix in Malaysia

	2000	**2009**
Oil	44%	38%
Natural gas	46%	42%
Coal	4%	15%
Hydro	1%	1%
Biofuels	5%	5%

Source: Renewable energy country profiles, Asia

In 2011, the Renewable Energy Act was enacted by the parliament of Malaysia, provided for the establishment and implementation of a special tariff system to catalyze the generation of renewable energy and to provide for related matters.

Under the act to regulate and develop the renewable energy industry in Malaysia, the Sustainable Energy Development Authority (SEDA) was established. The Renewable

Energy Act (2011) implemented the FiT mechanism to accelerate RE growth in Malaysia; since then, the RE installed capacity had grown from 53 MW in 2009 to 243 MW in 2014.

2.9 Review of the Literature on RE in Malaysia

2.9.1 RE Necessity and Potential in Malaysia

Many studies have investigated the necessity of renewable energy and its potential in the Malaysian energy sector. Tanggapan et al., (2011) explained that Malaysia had consistent GDP growth from 1970 to 2010 and that a renewable energy policy is justified based on its fundamental objective of obtaining a safe, cost-effective, environmentally friendly, and secure energy supply.

According to the 2011 third ASEAN energy outlook, Malaysia's final energy consumption grew at an annual average rate of 7.0%, from approximately 14.5 Mtoe in 1990 to 45.6 Mtoe in 2007. Keong (2005) claimed that it is expected that total final energy consumption will reach 116 Mtoe in 2020 based on an annual growth rate of 8.1% and that applying a renewable energy policy for the country is unavoidable.

Zamzam Jaafar et al. (2003) also mentioned that meeting the ever-increasing demand for energy in a sustainable manner is essential for boosting the country's competitiveness and resilience in the 21st century. Moreover, Rahman Mohamed and Lee (2006) described various alternative energy sources in Malaysia and emphasised that a major challenge faced by the power industry will be creating an effective and sustainable energy policy, and that meeting the increasing demand for energy in Malaysia in a sustainable way is essential.

Meanwhile, Shafie et al. (2011) reviewed energy condition in Malaysia. In explaining the dependency of Malaysia's economy growth on an uninterrupted supply of energy, they mentioned that Malaysia needs more resources to support industrial development and avoid shocks to the energy supply.

In addition, Oh et al. (2010) also indicated that, since it is expected that Malaysia will become a net oil importer by 2030, "an over-dependence on non-renewable fossil fuels in the Malaysia energy sector has made the country extremely vulnerable" and "promoting the use of RE is necessary".

Other studies also have highlighted the potential of renewable energy in Malaysia. Oh et al. (2010) summarized the estimations of RE's potential in Malaysia (see Table 2.5).

Table 2.5: Renewable energy potential in Malaysia

Renewable energy	Potential (MW)
Hydropower	22,000
Mini-hydro	500
Biomass-biogas	1,300
Municipal solid waste	400
Solar PV	6,500

Source: Oh et al (2010)

Sriram. (2006) indicated that the "abundance of solar radiation in Malaysia makes it highly potential for solar power generation". Nugroho (2010) and Jamaludin (2009) claimed that Malaysia's monthly solar radiation is about 400 to 600 MJ/m2 and is higher during the northeast monsoon. Likewise, Ahmad et al. (2011) pointed out that because of its strategic geographical location, "Malaysia benefits from a large quantity of solar insolation per year, ranging from 1400 to1900kWh/m2/year".

This means that Malaysia enjoys sunlight for more than 10 hours each day (Amin et al., 2009). Furthermore, Haris (2009) calculated that, by installing 1 kWp of solar panels across 431 km^2 of territory, the government could address the electricity requirements of the country. Mekhilef et al. (2012) considered the nation's equatorial location and explained that building large-scale solar power was Malaysia's best choice for future energy generation. This is because in Malaysia, wind energy conversion is a serious consideration.

The potential for wind energy generation depends on the availability of the wind resource, which varies across the country. Detailed knowledge of wind onsite is also needed to estimate the performance of a wind energy project. However this first requires a general assessment of the wind energy potential nationwide (Saidur, 2010). For instance, research on potential wind energy done in 2003 showed that the annual offshore wind speed was around 1.2 to 4.1 m/s for Malaysian waters. The highest potential is in the east of Peninsular Malaysia, which has annual vector resultant wind speeds of 4.1 m/s (Chiang et al. 2003).

Biodiesel is a type of RE that is produced from the reaction of vegetable oils or lipids as well as alcohol. It is highly suitable to serve as an alternative fuel for petro-diesel based compression ignition engines (Shekarchian et al., 2011). Malaysia's average annual rainfall is about 2000 mm, which is quite high compared to the international average (750 mm). Malaysia is considered a potential location for hydro-power plants; 9.5% of nominal capacity and electricity generation in 2008 came from hydro-power plants (National Energy Balance, Ministry of Energy, 2008). Hydropower is the only renewable energy technology that is commercially viable on a large scale in Malaysia (Ong et al., 2011).

Malaysia has a substantial amount of hydropower resources, and potential hydropower is estimated at 29,000 MW (NEB, National Energy Balance 2008). Although hydro power is considered to be a type of RE, it is usually categorized separately in the energy mix. Its share of energy usage is estimated to increase from 5% to 35% (from the year 2008 to 2030) in Peninsular Malaysia (Islam et al., 2009).

Furthermore, all these identified hydro projects will have a profound effect on the generation mix in Malaysia if implemented. However, problems related to land use, socio-economics, and environmental impact will make it questionable whether all of this potential can be harvested.

For instance, the hydroelectric potential in Malaysia is very significant (Jalal & Bodger, 2009). As hydro is an energy resource, 2,091 MW and 29 MW of hydro and mini hydropower facilities respectively were available in Malaysia in 2007. These constituted 9.6% and 0.1% of the installed capacity respectively (Ministry of Energy, Water .and Communications, 2007).

Hydrogen and fuel cells are identified as priority research by the Ministry of Science, Technology and Innovation (MOSTI) after solar, with RM 7 million (US $2 million) invested in hydrogen production and storage technologies between 2002 and 2007 (Islam et al., 2009).

Malaysia has been endowed with natural resources in areas such as forestry and agriculture. In the agriculture sector, oil palm trees are widely planted in Malaysia; thus, it is not surprising that it is the major biomass source. Oil palm residue, ranging from empty fruit bunches and fronds to the shell and mesocarp fibres, can all be converted to energy sources via combustion.

Even though palm oil is originally an African crop which was introduced to South East Asia in the 19th century, majority of its production happens in South East Asia, with the two largest producers being Malaysia and Indonesia. These two countries account for roughly 85% of the total production of palm oil.

In contrast, biomass is any woody based material from plants that store energy through photosynthesis. Substantial amounts of fuel wood, agricultural crops and residues, empty fruit bunches, animal waste, and leaves are used by households and industries (Ong et al., 2011b).

Malaysia is the largest palm oil producer in the world. It has approximately 362 palm oil mills, in which the country processes 71.3 million tons of fresh fruit bunch per year

and produces an estimate of 19 million tons of crop residue every year in the form of fibre, shell, and empty fruit brunch. (Sumathi, & Mohamed, 2008).The rates show that Malaysia is on the right path of using biomass fuels as a source of RE. This can set an example for other countries with huge biomass resources. (Shuit et al.2009).

As an RE, biomass has the potential to make the most contributions to the energy needs of modern societies both in industrialized and developing countries. Currently, biomass contributes to around 10 to 15% of global energy usage. (Demirbas et al., 2009).

Besides, Malaysia has been one of the largest producers and exporters of palm oil for the last 40 years, which having approximately 3.87 million hectares of land under oil palm plantation (Kannan, 2005). Ölz and Beerepoot (2010) reported that Southeast Asia Malaysia has the highest renewable electricity potential compared to its share of the ASEAN countries (See Table 2.6).

Table 2.6: Renewable energy potential in ASEAN

	RES-E		RES-H		RES-T	
	Per capita	Per unit of GDP(PPP*)	Per capita	Per unit of GDP (PPP*)	Per capita	Per unit of GDP (PPP*)
Indonesia	1.57	0.41	1.37	0.36	0.33	0.09
Malaysia	4.73	0.31	2.64	0.17	0.68	0.05
Philippines	1.23	0.37	0.42	0.13	0.16	0.05
Singapore	0.73	0.01	3.97	0.06	0.00	0.00
Thailand	1.85	0.23	1.96	0.25	0.46	0.06
Vietnam	2.18	0.78	1.52	0.55	0.23	0.08
ASEAN-6AVERAGE	1.76	0.34	1.38	0.26	0.31	0.06

Sources: IEA, 2009a

In summary, it can be concluded for the informants in this section that the realisable potential for renewables is large across Malaysia. Review of literate also revealed that

renewable energy policy is justified based on its essential objective to provide sustainable energy.

2.9.2 Factors Influencing RE acceptance and Development in Malaysia

A considerable amount of literature has been published on the RE situation in Malaysia. Several attempts have been made to address the barriers to renewable energy use in ASEAN countries broadly, without providing specifics on the situation in Malaysia (e.g. Lidula et al., 2007; Olz and Beerepoot, 2010; Chou, 2008). As mentioned before, the 'fifth fuel' policy implemented under the Eighth and Ninth Malaysian Plans (2000–2010) in terms of generating 5% of the country's energy from renewable resources has failed miserably (Goh & Lee, 2010).

Furthermore, the studies that focus on the renewable energy situation in Malaysia do not scrutinise the failures of the RE policy in the Eighth and Ninth Malaysian Plans and the factors that influence RE acceptance in Malaysia. .

For example, Oh et al. (2010) discussed the overall approach to addressing energy challenges and the complexity of existing energy policies in Malaysia, by focusing on a green technology policy launched in 2009. Ong et al. (2011) explored the current energy scenario and the use of alternative energy in Malaysia, predicting that, in the near future, the country would not be ready to shift from traditional resources to renewable energy.

A recent study by Ho (2016) indicated that, although Malaysia began its first RE initiative in the 1980s to provide non-grid solar photovoltaic electricity to remote areas and rural communities, power generation in Malaysia is still heavily dependent on fossil fuels. This means that the importance of RE has long been stressed though its development is slow.

Since biomass is one of the earliest energy sources and the most promising renewable energy source due to its numerous resources and its environmentally sound characteristics, Hosseini et al. (2014) studied the palm solid residue (PSR) generation from Malaysian palm oil industries.

Because Malaysia is an agriculture-based tropical country, many crops such as palm, paddy rice, and sugarcane are cultivated in this region. Hosseini et al. (2014) further concluded that, "although PSR utilization in power generation can be presented in clean development strategies category, some financial barriers such as the lack of support from the Government for electricity generation and the lack of appropriate subsidies and tariff for PSR-fired electricity have discouraged Malaysian private sector investment in this field."

Moreover, a recent systematic review of energy demand and renewable energy policies in Malaysia conducted by Bujang et al. (2016) concluded that, "Although existing policies point towards integration of sustainable energy resources, a more aggressive approach is needed to substantially offset fossil-fuel consumption."

A seminal study in this area is the work of Ahmad et al (2014), who used a multi-perspective approach based on the analytic hierarchy process (AHP) to find that the "availability of renewable resource and feed-in tariff rate are the most important sub-criteria from economical aspect while efficiency and maturity of technology from technical aspect". Meanwhile, Petinrin and Shaaban (2015) showed that Malaysian RE policies are not cohesive or inclusive. The same study explained that poor pricing between potential investors and the national utility has prevented RE developers from being keen on investing in RE power projects. Additionally, fuel suppliers are not committed to making long-term agreements with RE project developers, which may affect the reliability of the fuel supply.

Hashim et al (2011) asserted that lack of advanced technology for RE generation and lack of awareness of the benefits of RE resources are two main barriers to developing RE technology in Malaysia.

Lim and Lam (2014) used a survey to assess public acceptance of renewable marine energy in Malaysia and reported that '56.8% of respondents disagreed with paying an additional cost for raising the level of consumption of green electricity. Moreover, the higher income group was more unwilling to pay more to support green electricity'.

The reason for this result was linked directly to the NIMBY ('Not in My Backyard') attitudes of Malaysian citizens, who are unwilling to support green energy by involving themselves through either participating or paying money.

Mekhilef et al. (2014) studied Malaysia's renewable energy policies and programmes with green aspects and found that 'Malaysia still has a lot of potential in order to fully utilise RE resources. Hence, more collaboration between public and government needs to be performed to ensure a remarkable achievement.

Other than that, Umar et al. (2014) examined and identified the areas that require more attention in order to ensure that the current renewable energy policy framework is socio-economically sustainable and able to drive the industry forward, as finding niches that could be strengthened as part of renewable energy market reform. They argued that the critical challenge confronting the industry was maintaining progress towards sustainable development with a sound and dynamic policy instrument, and that appropriate policy support and sustainable solutions were needed to bridge any gaps in the downstream components.

Although such reviews have addressed some of the important aspects of the renewable energy situation in Malaysia, no peer reviewed studies have dealt with the factors that

affect citizen acceptance of RE in Malaysia. Thus, there is a need to evaluate the elements that affect renewable energy technology acceptance in Malaysia from a multi-dimensional perspective.

2.10 Technology Acceptance Model

Understanding how technologies diffuse among people has been studied in many fields. To explain the factors that promote or hinder the acceptance of a technology, several models have been proposed. Perhaps, the leading and most influential model is technology acceptance model (TAM) (Chuttur, 2009).

TAM can be considered a means of predicting technology usage (Turner et al., 2010). The model was developed by Davis (1989) to identify the factors that cause failures in systems and technology. In his model, Davis (1989) proposed that users' motivations can be explained by three factors: perceived ease of use, perceived usefulness, and attitude towards using (Fig 2.10). Therefore, TAM became the most influential theory to explain accepting technology.

Based on the TAM model, when individuals are introduced to new technologies, two major variables influence on how and when they will use the technology. These two variables are perceived usefulness (PU) and perceived ease of use (PEOU). PEOU is defined as "the degree to which a person believes that using a particular system would be free from efforts" (Davis, 1989, p.320).

Since the introduction of TAM, many studies have contributed to a better understanding of it by adding other variables and extending the initial model.

For instance, Adams et al. (1992) examined TAM for different applications and replicated the work of Davis (1989) to demonstrate the validity and reliability of the model scale (Hendrickson, 1993). Later, Taylor and Todd (1995) developed a hybrid model and combined the elements of the theory of planned behaviour (TPB) with the constructs of perceived usefulness and ease of use from TAM. This model is called the

'decomposed theory of planned behaviour' because the belief structure is decomposed in the model. This indicates that attitude is decomposed to include perceived usefulness, perceived ease of use, and compatibility.

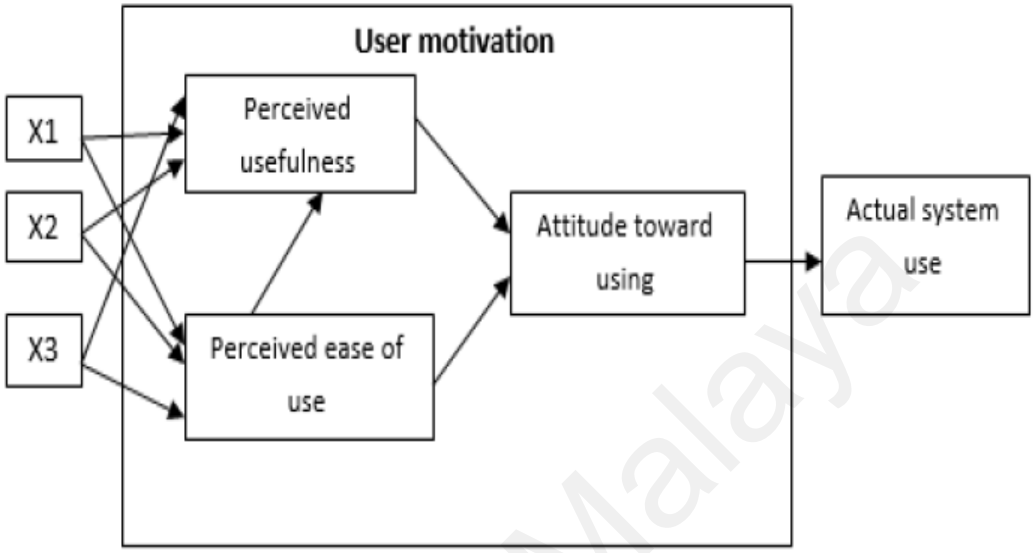

Figure 2.10: Original TAM proposed by Davis (1989)

TAM did not maintain its original form, but has ceaselessly evolved like an organic being. TAM has been applied to different technologies under different situations with different control factors and different subjects, leading its proponents to believe in its robustness (Lee et al., 2001).

2.11 TAM in Green and Sustainable Technology

The original TAM has been extended in many studies, mainly by examining the effects of external variables on internal beliefs, attitude and behavioural intention. Some studies have put forward comprehensive frameworks of energy technology acceptance based on technology acceptance studies to explain the intention to act concerning new sustainable energy technologies.

Midden and Hujits (2009) conducted research on the acceptance of carbon capture and storage and gene technology finding that the perceived risks and benefits of these technologies predicted attitudes to them. Likewise, studies on stated preference have

shown that costs, risks, and benefits influenced choices as well (Loewenstein & Lerner, 2003).

Besides, Molin et al. (2007) conducted research on the preferences for cars using alternative fuels such as biodiesel, hybrid, and hydrogen vehicles. They showed that the vehicle's price and performance were the most important factors in influencing customer preference.

Huijts, Molin, and Steg (2012) presented a comprehensive framework of energy technology acceptance based on a review of psychological theories, whereby they proposed a technology acceptance framework for understanding citizen and consumer acceptance.

The model was composed for sustainable energy technologies, green technology, and nanotechnology. In the framework, perceived costs, positive and negative feelings about the technology, risks and benefits, trust, distributive fairness, and procedural fairness were found in influencing attitude. Also, the factors that influenced personal norm were identified as perceived costs, risks and benefits, awareness of the dire consequences of not accepting the new technology, and outcome efficacy.

In another study, Huijts et al. (2014) used psychological variables to explain intention to act towards a local hydrogen fuel station. They examined the psychological determinants of citizens' supporting or opposing intentions to take action and developed a causal model based on technology acceptance. Three determinants of intention to act in favour of the technology were identified: personal norm, positive affect, and perceived effects.

Toft et al. (2014) analyzed the acceptance of electricity from renewable sources to gain independence from imported fossil fuels. As a response to climate change and the

tendency to become independent from imported fossil fuels, they combined TAM and the Norm Activation Model. They reported that smart grid technology could be better explained when the technology acceptance variables were included in TAM.

Moreover, the study illustrated that including personal norms to the independent variables of TAM could result in a significant increase in the explained variance of the consumer acceptance, when associated with the smart grid technology in all three countries.

Gupta et al. (2011) reviewed the socio-psychological determinants of the public acceptance of sustainable technologies and indicated that risk, trust, perceived benefit, knowledge, individual differences, and attitude were the focus of research on green technology acceptance. Although over recent year technology acceptance has become a focus of research in the field of green and sustainable energy, far too little attention has been paid to it in the Malaysian context.

2.12 Research Gaps

"Enhanced understanding of public awareness about global climate change can contribute to inform scientific and policy discussions of climate change. Scientists need to know how the public is likely to respond to climate impacts or initiatives and policy makers need to know what the public wants, in order to design policies that will be supported or at least tolerated." (Bord et al, 1988, p.75).

Meanwhile, more recent attention has been focused on the understanding of public awareness about climate change in developed countries. In addition, regular assessment of public attitudes on general environmental concern has become more popular in various countries. So far, however, there has been very few studies on public awareness in regards to climate change and renewable energy in Malaysia.

In order to gain comparative perspective on climate change matters in Malaysia

(Peninsular), a comprehensive study which provides insights into the evolution of public opinion in Malaysia regarding climate matters is necessary.

Moreover, although over recent decades published papers on technology acceptance have significantly increased (Gupta et al., 2011), there are relatively few studies in the area of renewable energy.

In addition, most previously published studies on TAM have focused on data from western countries (e.g., Sweden, the UK). As far as the researcher is aware, no comprehensive study has been made on model acceptance of renewable energy technology that has been published in a respective journal.

Last but not least, most studies on Malaysia's RE policy have only reviewed the RE situation. However, the literature on factors that influence to RE development is limited. This means that very few studies have examined the role of knowledge and public perception in renewable energy acceptance in Malaysia.

In this thesis, therefore, a comprehensive study on technology acceptance framework for explaining factors that influence RE technology acceptance on Peninsular Malaysia is designed, using both quantitative and qualitative approaches.

2.13 Conclusion

This section has reviewed various studies on green technology, RE policy and climate change. In this section, the historical energy policy in Malaysia also has been explained. This chapter has described several published papers about RE situation in Malaysia and we can conclude that there are little published data on elements infaunae renewable energy acceptance in Peninsular Malaysia.

CHAPTER 3: CONCEPTUAL FRAMEWORK OF RESEARCH

3.1. Introduction

This chapter presents the conceptual framework and hypothesised relationships emerging from this study. While the basic proposed model examined the direct effect of two variables perceived usefulness (PU) and perceived ease of use (PEOU) on attitude towards using renewable energy, the impact of two other variables (cost, knowledge) could be mediated by PU and PEOU in the model. The goal of this chapter is to discuss the proposed theoretical model (Section 3.2).

3.2 Proposed Theoretical Model Overview

As described in the previous chapter, this thesis provides an opportunity to advance our knowledge of renewable energy technology acceptance as a major part of green technology. For the first time, linkages between external variables (cost and knowledge), PEOU, PU and attitude to use renewable energy have been integrated into one interrelationship model. This model will help address the research gaps by providing new insights into accepting RE technology within the TAM framework.

The theoretical framework draws upon theoretical perspectives relevant to issues of RE acceptance in Malaysia: the TAM (Davis, 1989).

The theoretical framework for this study is presented in Figure 3.1. It comprises of two external variables (cost and knowledge) as well as PU, PEOU, and attitude in using technology.

The research model proposed in this thesis extends technology acceptance model in the framework of RE technology based on prior research on technology acceptance.

For instance, building a conceptual framework permits a better identification of the information needed for data collection and analysis, as well as a cross-case analysis of the same phenomenon (Miles and Huberman, 1994).

The model suggests that perceived ease of use (PEOU), perceived usefulness (PU) have an impact on attitude towards accepting the RE technology. As noted by Davis et al. (1989) external factors can be added in the model. Moreover, external variables combined in the model include cost and knowledge. The model also proposes that PU and PEOU mediate the effects of the cost and knowledge attitude towards using RE.

There seven main hypotheses in conceptual framework. Hypotheses H1, H2, H3, and H4 test the influence of each type of external variable (cost and knowledge) on perceived ease of use and perceived usefulness, respectively, while H5 tests the effect of PEOU on attitude towards using green technology, H6 tests the impact of PEOU on PU, and H7 tests the linkage between PU and attitude towards using technology.

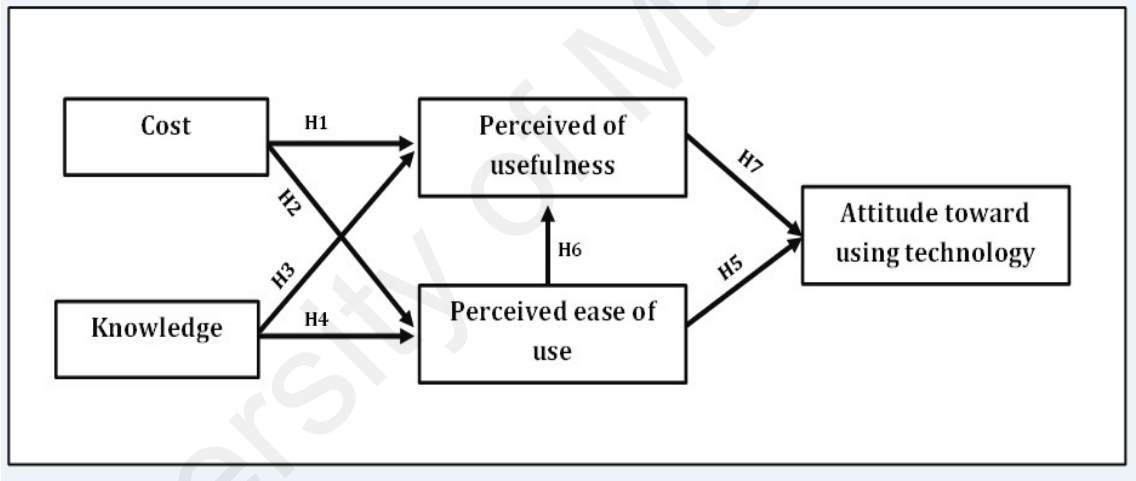

Figure 3.1: Conceptual framework
Adopted from Davis at al. (1989)

To demonstrate that the use of the adopted conceptual framework is a relevant and powerful tool for studying RE technology acceptance in Malaysia, we will briefly explain the five elements of the model.

3.2.1 External Variables

Many studies on the factors that impede the adoption of a new technology consider two elements – cost and knowledge – as the main issue to the acceptance of renewable energy technology.

3.2.1.1 Cost of Renewable Energy Technology

The element of cost can be considered an external variable. Attitudes towards using new technology are influenced by beliefs about the technology itself, which can be specified as perceived costs in the context of the effects of the technology (Huijts et al., 2014). Achterberg et al. (2010) pointed out that hydrogen technology is unknown among users because of the positive and negative effects of its perceived costs.

Meanwhile, Steg and Vlek (2009) suggested that low-cost environmental behavior and 'good intentions' can be considered as environmentally beneficial behaviors. It has been shown that apparent interface and safety risks can cause resistance. This is in addition to the fact which people believe that collective properties could be consumed in an improved way or that the cost–benefit relation is excessively low. Thus, public resistance can hinder the implementation of sustainable energy technologies.

According to Huijts et al. (2012), people typically select the options that come with maximum gain and minimum costs. They conclude that people select to utilize technology considering weigh of costs, benefits and the risks involved. Steg and Groot (2010) empirically concluded that the perception of cost influenced personal norm and (indirectly) intention to accept new technology.

As Likewise, de groot et al. (2010) suggested that cost has to be the supplementary predictor to accept the energy technology conditions. They performed a questioner study amongst a portion of Dutch population in order to inspect the reasons that influence people's enthusiasm to take action for nuclear energy. Therefore, it can be hypothesized that:

H1: Cost (cost of using renewable energy) will have effect on the PU.

H2: Cost (cost of using renewable energy) will have effect on the PEOU.

3.2.1.2 Knowledge

Knowledge is another factor considered as an external variable. There are few aspects that can have an effect on people's insight and their acceptance, including gaining knowledge about how technology works as well as getting to know the technology properties. (Montijn & Midden, 2008)).

Molin (2005) showed that "people with more knowledge of hydrogen as a fuel perceived fewer safety risks, which was related to a less positive attitude towards using hydrogen as a fuel and willingness to use hydrogen-fueled technologies. However, people with less knowledge of hydrogen as a fuel also perceived more environmental benefits of its use, which indirectly led to a more positive attitude and willingness to use it" (p.243).

According to literature, the knowledge of a technology and acceptance associations has been examined extensively. For example, Achterberg (2010) reported that impacts of knowledge on acceptance of hydrogen technology is evident.

A survey performed by Duan, 2010 for carbon storage found a positive relationship between people's acceptance and the effect of knowledge. Also, Ellis et al. (2006) showed that there is a connection between knowledge and the acceptance of wind power. Other than that, Siegrist and Cvetkovich (2000) emphasized that the higher the self-rated knowledge level for a hazardous technology is, the stronger the attitude towards using it.

House et al. (2014) found that intentions to accept GM food products were influenced by knowledge. Therefore, the following hypotheses can be presented:

H3: Knowledge (knowledge about RE) will have effect on PU.

H4: Knowledge (knowledge about RE) will have effect on PEOU.

3.2.2 Perceived Ease of Use

In TAM, "perceived usefulness (PU) together with perceived ease of use (PEOU) are indicated as fundamental and distinct constructs that influence an individual's decision to use technology or systems" (Davis, 1989, p.154).

For Moore and Benbasat (1991), PEOU is "the degree to which an innovation is perceived as being difficult to use". Davis (1989) defines perceived ease of use as the "degree to which a person believes that using a particular system would be free of effort" (p. 320).

There is a consensus about the influence of PEOU on PU and attitude towards using technology (e.g. Davis, 1989; Mathieson, 1991; Moore and Benbasat, 1991).

Tornatzky and Klein (1982) further support the idea of importance of perceived ease of use. This can be seen when the complexity of an innovation was found to be among three factors, with the most consistent noteworthy relationships among many types of innovation. This hypothesis is shortened in the following premise:

H5. PEOU will have effect on attitudes toward using technology.
H6: PEOU will have effect on PU.

3.2.3 Perceived Usefulness

Perceived usefulness has been proven to be the most significant element in explaining why people adopt a technology and thus "has remained relatively unchanged since the inception of the research stream" (Yeh, 2009).

For instance, Davis (1989) defines perceived usefulness as a user's belief that the use of technology improves performance.

The justification for this proposition is that, "If people expect a technology to increase their performance on the job, their intentions to use the technology will be greater than

will that which can be attributed to their attitude towards the technology" (Amoako-Gyampah, 2007.p.298). The extent to which a successfully executed behaviour is considered to be connected to valued outcomes is called Perceived usefulness. (Chuttur, 2009). Venkatesh et al. (2003) claimed that perceived usefulness has been consistently proven to be the most powerful predictor for intention to use in technology adoption.

Likewise, Han (2003) pointed out that the 'importance of PU in determining usage behaviour should be emphasized'. It is worth mentioning that prior to the introduction of TAM, the importance of PU in forecasting user intention to use a technology was stressed. For instance, Schultz and Slevin (1975) in an exploratory study reported that PU had a direct effect on attitude toward using technology.

As perceived usefulness is predicted by PEOU and predicts attitude, thus it can be used as both a dependent and independent variable. Therefore, one of the focuses of the theoretical model is examining the impact of PU on attitude towards using green technology. Therefore, the hypothesis is:

H5. PU will have effect on attitude toward using RE.

3.2.4. Attitude towards Using Technology

Attitude is one of the several terms frequently used in TAM (Huijts et al., 2011). Fishbein and Ajzen (1975) define it as an "individual's positive or negative feelings (evaluative affect) about performing the target behavior" (p. 216). In the original TAM, David (1989) defines it as a personal evaluation in regards to the usage of the system; it was suggested that perceived usefulness and perceived ease of use lead to individual intention to use trough attitude towards using. TAM postulates that both perceived usefulness and ease of use affect one's attitude. Venkatesh et al. (2003) mentioned that attitude is an individual's affective reaction to using technology. Many studies have

pointed out that for predicting the usage of a new technology, attitude can be considered a strong construct. For example, Chau and Hu (1999) reported that attitude was the second most important factor in intention to accept technology.

According to literature, PU and PEOU affect AT within the TAM model. Lucas et al. (1999) examined the relationship between technology acceptance and user performance and found a positive relationship between PU and AT and between PEOU and AT.

Researchers who have extended the TAM have also suggested that both perceived usefulness and ease of use affect attitude toward using technology (Venkatesh & Davis, 2000a; Yiet al, 2006). Attitude towards acting regarding a local hydrogen fuel station was measured as a general evaluative judgment about taking the suggested seven actions in favor of or against a local hydrogen fuel station (Huijts et al., 2014).

TAM declares that approach toward utilizing a technology is a main cause in examining technology acceptance, that is why a technology use is often measured as incidence of use and expected future usage.(Han, 2003).Accepting new technology was shown to be affected by attitude towards technology in TAM (Ahlan & Ahmad, 2014).It is important to note that attitude to using a particular technology is measured more frequently than is actual usage (Turner et al., 2010).

3.3. Conclusion

This research extends eminent technology acceptance model by adding two external variables comprising; cost and knowledge to TAM. These factors have been recognised on the basis of their important influence on the acceptance of RE technology in technology acceptance literature. The conceptual causal model of this study proposes seven hypotheses from H1 to H7, which have been discussed in this chapter.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

Methods used in this thesis are defined and discussed in the current chapter. The second part moves on to describe about research approach. The third part (4.3) provides details about quantitative research design. Section 4.4, 4.5 and 4.6 explains the sampling strategy, sampling and sample size. The procedure of data collection is explained in section 4.7. With respect to survey questionnaire, section 4.8 provides needed information. Section 4.9 and 4.10 describe Pre-test and pilot study respectively. Section 4.11 explains the data analysis procedures. Section 4.12 elucidates the structure equation model (SEM) used in this thesis. It then goes on to describe two stage SEM (4.13). Reliability and validity are argued in section 4.14. The next section of this chapter is about qualitative data collection. The conclusion is presented in Section 4.16

4.2 Research Approach

According to Kuhn (1996), it is essential to establish rules and principles for every research. Guba and Lincoln (1994) explained that a research approach defines the restrictions in which a researcher is supposed to perform his/her research. They also pointed out that each research methodology can be considered as part of a paradigm. To select a research methodology, a researcher has to take into consideration several elements, including the research queries and the nature of the phenomenon under study (Bryman, 2001; Yin, 1994).

4.2.1 Research Approach Applied in this thesis

Researchers should have known that just one single source of data, observation, instrument or interview is not reliable for their research (Mills, 2003, p.52). In terminology of research, the aspiration of using multiple resources of data is known as triangulation (Mills, 2003, p. 52). In the current research the two methods of qualitative

and quantitative have been utilized. Qualitative evidence is valuable for further conceptual justification. “The quantitative method is conventionally based on the positivist approach to explore scientific inquiry of the phenomena. This also underlies the deductive model which shows hypothesized relationships. The proposed relationships are obvious” (Aaker et al, p.79). On the other hand, qualitative approach focuses on situation which cannot always be simply quantified (Beedles, 2002).

In the current research methodological triangulations were used. This method was implemented by collecting data from different sources, plus using multiple method containing semi-structured interviews, surveys and document analysis. Triangulation is a procedure in which several viewpoints and approaches can be verified in order to increase the validity of the process (see Figure 4.1). Triangulation is a method of combining two or more concepts, procedures, theories or ideas in a singular study in order to unite in one construct and can be applied mutually in quantitate and qualitative investigations. Research debates about the association between quantitative and qualitative approaches, predominantly in evaluative research, have utilized a combination of different methods (Blaikie, 1991).

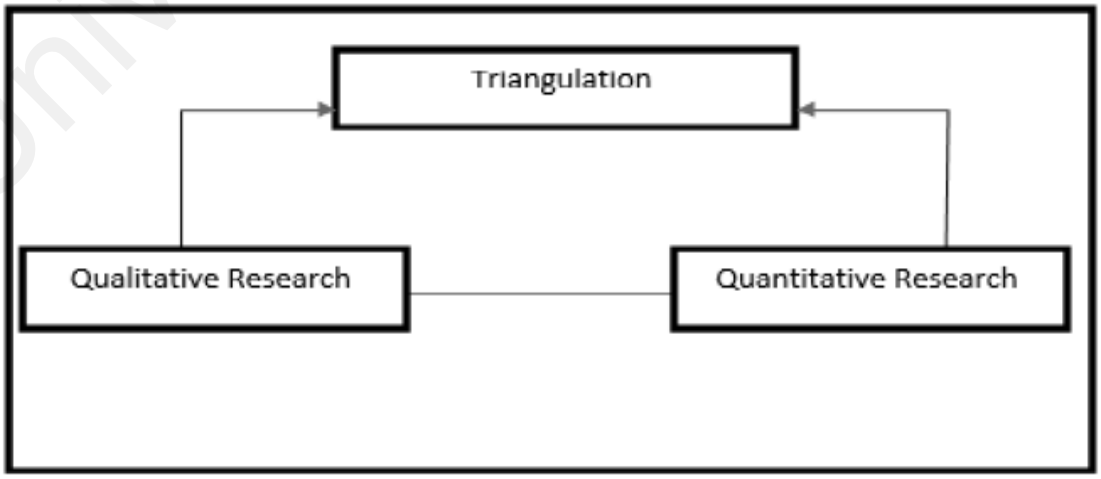

Figure 4.1: triangulation approach
Source: Blaikie (1991)

Recently, the application of qualitative and quantitative approaches to study a singular phenomenon has received major consideration among researchers. Application of triangulation can be traced back to Campbell and Fiskel (1959). This was later on used by Web (1966) and expanded by Denzin (1970) further than its conventional connotation with research approaches.

Triangulation has been explained in many different methods and each one has articulate proponents. Four forms of triangulations may be classified in terms of comprising data triangulation, investigator triangulation, theoretical triangulation and methodological triangulation (Denzin, 1970).

Data triangulation was explained as recovering information from several different sources to make one body of data. Investigator triangulation illustrated as gathering and explaining data utilizing various observers as an alternative of single form. Theoretical triangulation defined as interpreting data using more than one theoretical situation. Methodological triangulation demonstrated as information collecting approaches utilizing more than one research method.

Depends on the nature of the study, one or more than one of triangulation types can be used. Methodological triangulation symbolizes the most common meaning of the concept.The conventional advantage referred to by many methodologists is the authentication of qualitative data by quantitative studies. Triangulation offers researchers with several crucial opportunities comprising more reliable results by confident researches, new approaches to capturing problems and stimulate performing creative methods. (See figure 4.2)

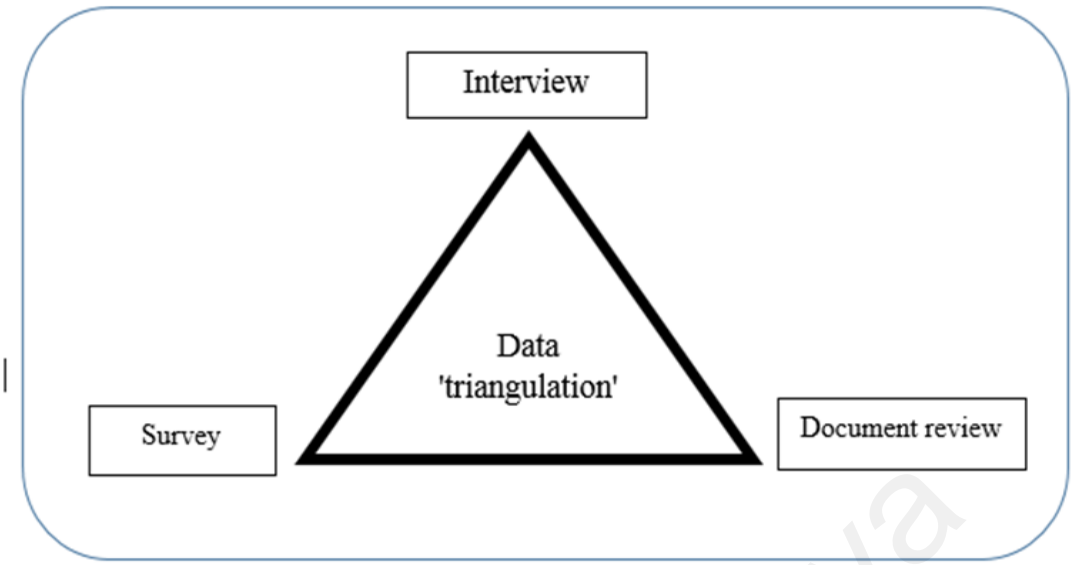

Figure 4.2: Source of data in this study: data triangulation
Source: Blaikie (1991)

The sequence for applying triangulation is seen in Figure 4.3.

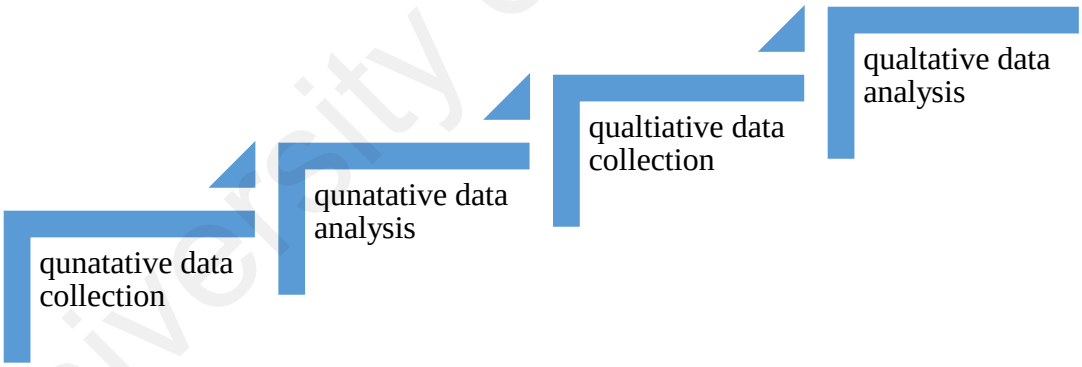

Figure 4.3: Sequence in triangulation
Source: Blaikie (1991)

The literature has emphasized the importance of combining quantitative and qualitative approaches in a significant study. (Denzin, 1989; Strauss & Corbin, 1990).Combining the quantitative and qualitative techniques could aid to improve the quantitative output with rich interview data. (Beedles, 2002).

4.3 Quantitative Research Design

Having a research strategy to function as a research project is really fundamental. In this study, the first step was to perform exploratory research to collect contextual material regarding research problems and previous studies related to this one. Following by a descriptive research strategy to describe the features of the respondents. Finally, explanatory research was performed to explain the relationships between constructs in the model. Figure 4.4 depicts the research design.

As far as quick, economical, and efficient is concerned, survey technique could be employed (Creswell, 1994). The purpose of survey is understanding the large population from which the sample was initially selected. In current study, the survey method was utilized to acquire data regarding the usage of renewable energy and deal more directly with the respondents' thoughts (Yin, 1994; Zikmund, 2003).

4.4 Sampling strategy

4.4.1 Target Population

The target population is made up of units, the outcomes of the survey are intended to be represented for these units. The target population for a survey is the entire set of units for which the survey data are used to make inferences (Zikmund, 2000). Eligibility of sample for considering for being surveyed is dependent on the target population, thus it is important to define target population specifically.

In this study, the target population consisted of all peninsular Malaysian citizens aged 20 years or older with higher education (including trade and technical institutions and post-secondary and tertiary schools), accounting for 21.75% of the population in this area.

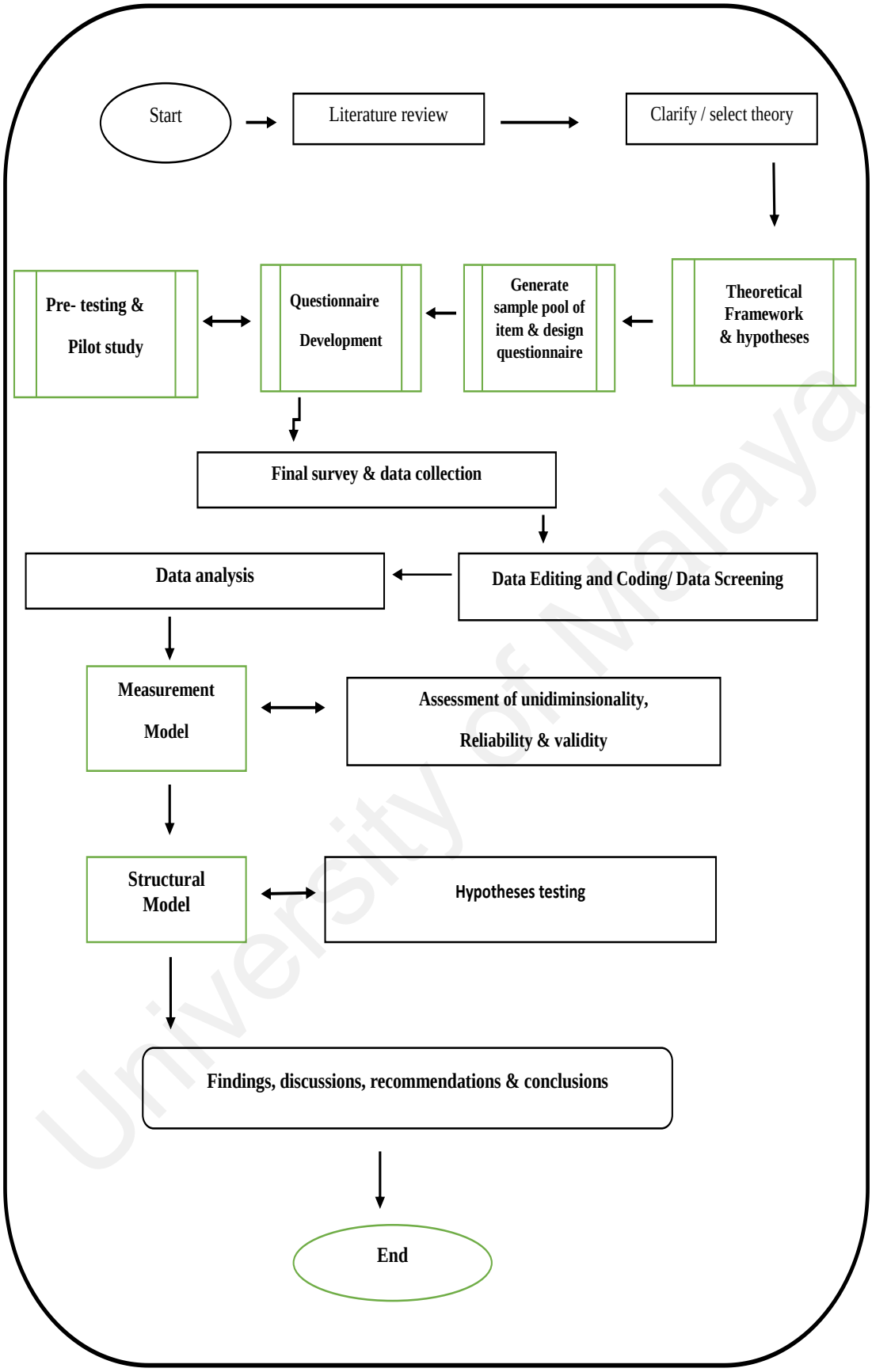

Figure 4.4: research design in this study

4.5 Sampling

Sampling aims to collect information about a population (Gay and Airasian, 2000). It is impossible for a researcher to distribute questionnaires throughout an entire population due to the restrictions of time and money. There are two sampling procedures: probability sampling (used in quantitative research) and purposive sampling (used in qualitative research). These are categorized into four groups (Teddlie & Yu, 2007). Table 4.1 lists these categories. The probability sampling is applied in quantitative research, and the purposive sampling is used in qualitative studies.

According to Tashakkori and Teddlie (2003) Probability sampling techniques involve "selecting a relatively large number of units from a population, or from specific subgroups (strata) of a population, in a random manner where the probability of inclusion for every member of the population is determinable" (p. 713).

Table 4.1: Sampling categories

Probability Sampling	Purposive Sampling	Convenience Sampling	Mixed Methods Sampling
A. Random Sampling B. Stratified Sampling C. Cluster Sampling D. Sampling Using Multiple Probability Techniques	A. Sampling to Achieve Representativeness Or Comparability B. Sampling Special Or Unique Cases C. Sequential Sampling D. Sampling Using Multiple Purposive Techniques	A. Captive Sample b. Volunteer Sample	A. Basic Mixed Methods Sampling B. Sequential Mixed Methods Sampling C. Concurrent Mixed Methods Sampling D. Multilevel Mixed Methods Sampling E. Combination of Mixed Methods Sampling Strategies

Source: Teddlie & Yu (2007)

The key goal of probability samples is to attain representativeness so that the sample accurately represents the entire population. Turning now to purposive sampling. "In this type of sampling specific persons, events, or settings are chosen purposefully. The reason for this selection is the essential information they can afford which could not be attained from other elections. (Maxwell, 2005, p. 87). In the current research probability sampling and purposive sampling are applied in quantitate and qualitative parts respectively.

4.5.1 Sampling Using Stratified Cluster Techniques

In environmental researches, two-stage cluster sample is the most frequently used sampling strategy. The two-stage cluster sampling approach – stratified cluster sampling in this research- integrated an incorporation of cluster and stratified sampling methods. Because the two-stage cluster design afford an opportunity to represent analyses at more than one level at data collection, many of the researchers prefer to use it.

"The two-stage cluster design has several benefits including, reduction of unnecessary sampling faults as it only has two stages of sampling, the second stage sampling utilizes residence which promises the best coverage of the goal population and It promises an illustrative sample of the goal population when a list of all goal individuals is not available" (Hansen et al, 1953.p.198). Thompsom, S.K. (1990) uses term 'cluster' to address a natural assemblage of people like household, schools, streets, villages, and towns. In this research the sampling of clusters was a two stage process.

A random sampling of cities inside every single stratum or region was included in the first stage of cluster sampling. Within each chosen city, a proportion of each region (city) was identified (see table 4.3). The systematic random sampling of proportion of every individual city was contained within the second stage. The separation of the country into distinct regions was perceived as stratification but not the first stage in a multistage sampling process.

4.5.2. Stratification

In this study, firstly, Peninsular Malaysia was stratified by region. Stratification is the procedure in which the survey population is separated into homogenous subsections utilizing certain principles. The aim of stratification is to reduce sampling errors. The outcome of a homogenous population is samples with smaller errors in comparison to a heterogeneous population. The researcher should make sure that from homogenous subsets of the population appropriate numbers and elements are drown in the stratification.

Organizing the population into homogenous subsets and choosing appropriate number of elements from each is the crucial role of stratification. For the purpose of representation of the population in Peninsular Malaysia, in this study, stratification by region is implemented. Stratification techniques employed to refine and improve the sample have been selected in multistage cluster sampling. Now, at first the list of geographical regions would be stratified by determination of the level and kind development for every region by the researcher.

In this research two-level stratification is applied. In this method the population was stratified firstly by region and then by cities inside regions. A subgroup of homogenous units is stratum. In stratum the sample may be planned differently and is chosen distinctly. The data used in this paper were collected from residents of peninsular Malaysia, focusing on urban areas in the following zones: North Zone (Kedah), Central Zone (Kuala lumpur), South Zone (Johor), and East Zone (Terengganu).

It should be noted that selecting of each region or stratum (subgroup of homogeneous units) is based on economic corridor which is declared by Tenth Malaysia Plan. In the Tenth Malaysian Plan to propel the economic growth of the country, a number of regions namely Northern Corridor Economic Region (NCER), Johor Bahru and Iskandar

Malaysia, East Coast Economic Region (ECER); Kuching and Sarawak Corridor of Renewable Energy (SCORE); and Kota Kinabalu and Sabah Development Corridor (SDC) are recognized.

Accordingly, considering the fact that the scope of this study is peninsular Malaysia (west Malaysia) and east Malaysia is not in the scope of this study (Sarawak and Sabah) , three corridors in peninsular Malaysia (Northern Corridor, Johor Bahru and Iskandar, East Coast Economic Region), in addition to Kuala Lumpur, were selected as the four regions for data collection.Table 4.2 illustrates the four regions and four cities from each region selected as representative of each region (first stage of cluster sampling).

Table 4.2: Characteristics of regional stratification

State	Characteristics
North Zone: Kedah	Agriculture and natural resources such as forests , strategic location
Central Zone: Kuala lumpur	Urbanization, progress and rapid development for last 50 years
South Zone: Johor	Land-use aggressive , accessibility to leading Asian cities, encompassing
East coast Zone: Terengganu	Abundant natural resources , biodiversity, oil & gas, tourism and fishery

Source: Developed by researcher

4.6 Sample Size

One of the most commonly asked questions by researchers is, how large a sample should be for a particular research (Maxwell et al., 2008**).** To find a sufficient sample size with a potential to estimate the population prevalence with a good accuracy is the purpose of this calculation. There are several different criteria that need to be specified in order to define the appropriate sample size including, population size, the level of confidence, the level of precision and level of variability in the measured features (Miaoulis &Michener, 1976).

Sample size plays an important role in all statistical analysis. Therefore, needed sample size in this research was estimated based on the statistical analysis technique (SEM). As noted by Hair et al. (2006) one important consideration in SEM is obtaining appropriate sample size.

According to Harris and Schaubroeck (1990) a sample size could be as small as 200.Kline (2005) proposed that a SEM needs a sample size of 200 or larger. A sample size with a minimum of 500 should be enough for Gerbing and Anderson (1993).

It is understood that the small size of the sample may become less problematic if the sample is completely randomly established and it is a precise presentation of the large population of interest (Loehlin, 1992). Following above references, the central concern regarding sample size was to attain a minimum of 500 usable responses.

4.6.1 Strategies for Determining Sample Size

There are several approaches to determining sample size, including using a census for small populations, imitating the sample sizes of similar studies, using published tables, and applying formulas to calculate the sample size (Israel, 1992). Each strategy is discussed below.

4.6.1.1 Census

Census refers to use the whole population as the sample. "A census eliminates sampling error and provides data on all the individuals in the population. In addition, some costs such as those for questionnaire design and developing the sampling frame are fixed" (Israel, 1992, p.2). On the contrast with some advantages census surveys have, they are the most physically demanding and time-consuming. It should be noted that census needs to statistical data from each member of the population. Considering its limitation, this study has not used a census to collect data.

4.6.1.2. Published Tables

Another way to determine sample size is to rely on published tables that provide the sample size for a given set of criteria. Krejcie and Morgan (1970) came up with a table for determining sample size for a given population for easy reference.

4.6.1.3 Formulas

The number of answers that are required to be acquired are provided by sample size formulas. The sample size is usually enlarged about 10% by most of the researchers. This addition is for the purpose of compensating for the persons the researcher could not contact. Based on these incensements of the sample size, the number of respondents could be significantly bigger than the needed number of a wanted level of precision and confidence for large populations, Cochran (1963) developed the equation to yield a representative sample.

Cochran (1977, p.81) pointed out that "One method of determining sample size is to specify margins of error for the items that are regarded as the most vital to the survey. An estimation of needed sample size is firstly made separately for each of these important items" this formula was used to calculate the sample size for this study because the target population was large.

4.6.1.4 Using a Sample Size for a Similar Study

The next approach to determine the sample size is utilizing the sample size of a similar study. If the engaged procedures in these studies are not reviewed, the risk of repeating made errors in determining the sample size for another study may run.

This approach is considered important for calculating sample sizes. Applying this approach, seminal studies to this thesis is reviewed to gain guidance about 'typical' sample sizes.

For example, a seminal study for this project is conducted by Chou (2013), who explored the risk perceptions of climate change in Taiwan. In this study, 1,100 samples were collected. Similarly, in 2005, form 1st of October to 6th of November, the British survey was conducted. This survey was about climate change.

The market and opinion research company MORI interviewed a national representative quota sample of 1,191 people face-to-face in their own homes. The people in this research were aged 15 and more. (Poortinga et al., 2006).

In the same vain, a Japanese survey on public perceptions of climate change and the future of energy was conducted between January 11 and 28, 2007. The data were collected by the Shin Joho Center Inc. In this survey a nationally representative sample of 959 people aged 20 years or older was interviewed face-to-face in their own homes (Aoyagi et al., 2011).

Tsantopoulos et al. (2014) also examined the attitudes of Greek citizens regarding changes to the legislative framework that would disallow new applications for the installation of photovoltaic systems through the completion of 1,068 questionnaires.

A survey study by Von Borgstede et al. (2013) collected 742 responses to explore public opinions regarding climate change and mitigation options and examine how psychological factors such as attitudes, norms, and willingness to pay determined self-reported energy-efficient behavior.

4.6.2 Sample size in this study

Making decision on determining the size of sample depends upon two key factors; precision of measurement for the sample and the variability in population in terms of the basic characteristic of the sample under study (Duas, 1991, p.78).

Regarding the relationship between the size of sample and the precision of measurement, it is worth mentioning that when we decrease the variability in sampling, the size of sample will be increased. In other words, the less the variability estimates, the larger the size of the sample (will be). By raising the level of Confidence Interval, the size of the sample will be larger as well (Jahanlu, 2010, p. 41). In fact, by halving the sampling variability, the size of the sample will be four times larger (Duas, 1991, p.78). However, the increase in the precision of measurement will be led to the rise in the cost of the size of the sample from some point on. In this study, confidence interval was considered 95%, and variability estimates were taken 0.05~0.01 to determine the size of the sample.

One of the other cases that will have an impact on determining the size of the sample is the variance of the variable(s) under study. We need smaller sample size in case our sampling takes place in a convergent community.

The less the variance, the more convergent the community will be (Jahanlu, 2010, p. 40). In reality, when most of the people or just few of them answer the questions in a particular way, the sample size will be smaller (Duas, 1991, p. 79). In this research, the designed questionnaire was applied to 120 people of the community as the pilot study (preliminary study). The results of the pilot study showed that distribution of accepting Green Technology is considerably varied among citizens of Peninsular Malaysia. This indicates a divergent community in which larger sample size is a necessity to increase the precision of measurement. The population participated in this study were citizens of Peninsular Malaysia with age range of 20 and higher, all had higher education degrees. To determine the sample size, Cochran Formula was initially applied. When the size of the population is clear, Cochran formula acts as below;

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left[\frac{z^2 pq}{d^2} - 1\right]}$$

In this formula; n= size of sample, N= population, t or z= standard deviation of acceptable confidence interval, p= a proportionate of the population who lacks the given characteristic, q= a proportionate of the population who lacks the given characteristic, d= degree of confidence/certainty with optimal probable precision.

Since the exact divergence is unclear to us, we take the highest divergence degree into account and replace 0.5 for p and q. We also consider 1.96 for interval confidence and 0.5 ~ 0.01 for variability estimates. The number of the sample would be thus as follows;

$$n = \frac{\frac{(1.96)^2 \times (0.5 \times\ 0.5)}{(0.05)^2}}{1 + \frac{1}{2249694}\left[\frac{(1.96)^2 \times (0.5 \times\ 0.5)}{(0.05)^2} - 1\right]} \cong\ 384$$

Considering the fact that 2249694 people of Peninsular Malaysia participated in this study, the presuppositions of the formula would be realized as; Interval Confidence= 95%, t= 1.96, p=q=0.05, d= 0.05.The sample size will be estimated as 384, as per the above (Cochran formula). This sample size will be increased due to some considerations.

Firstly, as stated earlier, the pilot study showed that the variance among variables refer to the difference(s) among the population. In such case, the larger sample size is necessary. Secondly, investigating the earlier studies in similar cases (see section 4.6.1.4) with almost similar characteristics indicated that choosing the sample size of 700~1000 people can guarantee the sample is the exact representative of the population. Thirdly, some researchers suggest that if we use cluster sampling approach, we need to increase the sample size three times more to compensate the systematic error types (Jahanlu, 2010, p. 41). By considering above points, the researcher had to increase the sample size two times more than the size estimated by Cochran formula to compensate the systematic error type and the sample size therefore reached to 768.

However, since the researcher had to deem the sample size 10% more than the estimated one to cover the probable missing of respondents during the study, the sample size increased to 850 people. The sample size of this study was in the end 850 people.

4.6.3 Sample Allocation

After selecting four regions for conducting stratified cluster sampling, the proportion of each region was identified considering the percentage of each region out of the total population of peninsular Malaysia. (See table 4.3)

Table 4.3: Sample allocation

	Peninsular Malaysia	South region	East coast Region	Central region	North region	SUM
Total Population	22,496,94	4,169,393	4,076,401	8,157,836	6,093,318	22,496,948
Citizens aged 20 years or over with higher education (frequency)	4893086 21.75%	1,001,036	801,692	2,229,808	1,112,030	10037652
Citizens aged 20 years or over with higher education (%) (A)		20%	16%	42%	22%	100
Percentage of sample (850)		20%	16%	42%	22%	100
Proportional allocation sample sizes (850)		170	136	357	187	850

4.7. Data Collection Procedure

In the quantitative part of the study, the multi-stage cluster sampling has been used. This technique is one type of probable sampling that guarantees the final selection of various samples (Duas, 1991, p. 74). In multi-stage cluster sampling, the main chore is selecting a sample among the main areas. In fact, the sampling takes place among big

areas first, then the smaller areas will be sampled out of each big area gradually. In the end, the sampling will be ended to selection among families and a method for selection among those selected families. The stages of sampling with application of above technique in one of the selected cities of Malaysia (Johor Bahru) is illustrated as follow.

In the first stage, as it is shown in the figure 4.5, Johar Bahru is divided into 5 distinct areas based on population density (considering streets, administrative, commercial and residential centers). List of districts is the framework for sampling and a sample of district would be chosen by means of simple random sampling. In such case, everyone who lives in a distinct area would have an equal chance to be chosen as a member of the final sample.

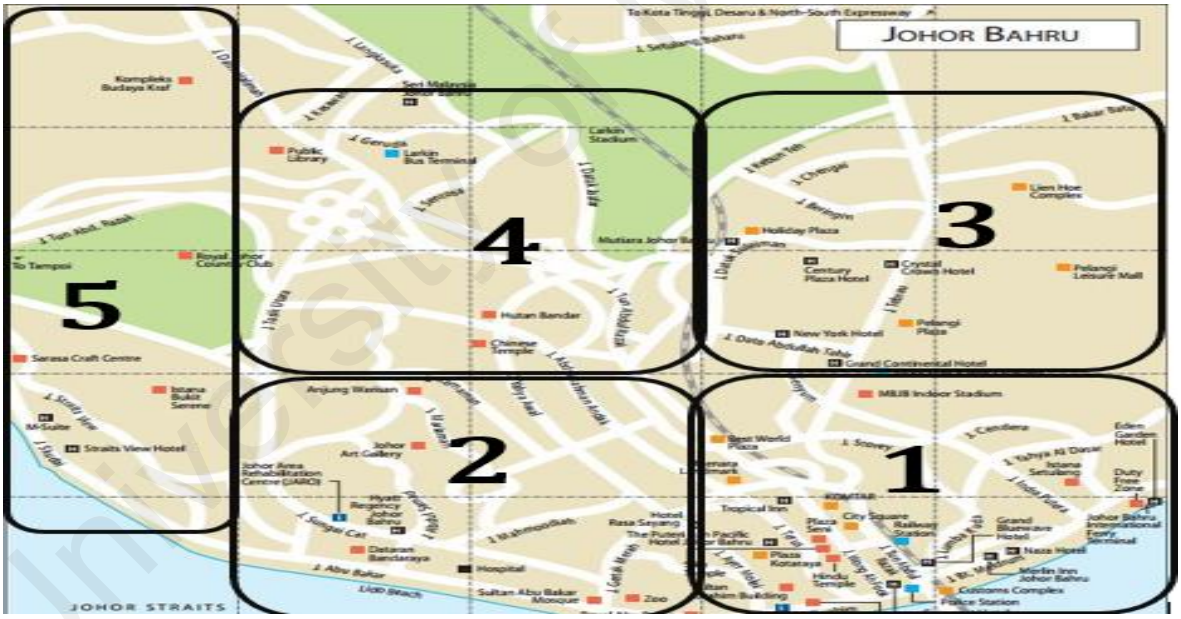

Figure 4.5: Division of Johar Bahru into 5 district

In the second step, the regions have been divided into blocks. Then a sample will be selected from the blocks of each region. In this part, the list of blocks of each selected region is provided by means of Google Map images. A random sample of the blocks of each region is then selected. The point worth mentioning is that distribution of population

in various districts of city (Johar Bahru) is quite different. In other words, population density in various parts of the city is not the same.

There is a direct relationship between the number of selected clusters and the number of units among which a sample would be selected. The more the units' density in the selected areas, the more units will be selected from each region. In such case, the modified version of multi-stage cluster sampling, that is, proportionate size probable sampling would be applied.

In the last stage, the closest/most crowded squares/areas, or parks in the selected streets would be determined and the samples would be chosen randomly. In this method, the probability of selecting each street depends upon the number and the population density in each area.

In this stage, in each district a list of main streets has been prepared and the streets will be selected randomly based on a given sharing. Sharing the streets selection is based upon population density in the regions.As it was mentioned earlier, in this study, the quantitative assessment and the instrument of research was the questionnaire. The observing samples were citizens with age 20 and/or more all having higher education degrees.

These people who have been selected randomly would be interviewed via a multi-stage cluster sampling. Due to the large sample size (850 questionnaires) and dispersion of questionnaires distribution (4 corridor in Malaysia), it was supposed to ask experienced students to give a hand. Students of social sciences were chosen and debriefed on how to interview with people during some sessions.

Table 4.4: List of streets of each district in the Johar Bahru

The selected districts	The share for units selection	List of streets
District 1	**Selecting 4 streets**	- *Jalan Sultan* - *Jalan Setulang* - *Jalan lunba* - *Jalan Biru* - *Jalan Storey* - *Jalan Dhoby* - *Jalan jereja*
District 2	**. Selecting 3 streets**	- *Jalan Mahmoodiah* - *Jalan Yahya* - *Jalan Abdul Rahman* - *Jalan Abdul samand* - *Jalan Gertak* - *Jalan khalid Abdulah* - *Jalan Gereja*
District 3	**Selecting 3streets**	- *Jalan Kuning* - *Jalan serampang* - *Jalan Biru* - *Jalan Abiad* - *Jalan Sutera* - *Jalan Bakar batu* - *Jalan Beringin* - *Jalan kesa* - *Jalan dato*
District 4	**Selecting 2 streets**	- *Jalan Harimah* - *Jalan serama* - *JalanTasik Ultra* - *Jalan Yehya* - *Jalan Ulu Air Molek* - *Jalan Dato jaafar* - *Jalan Kebun the* - *Jalan Kebun*
District 5	**Selecting 2streets**	- *Jalan Nong Chilk* - *Jalan Sungai* - *Jalan tasik* - *Jalan tasik ultra* - *Jalan Harum* - *JalanSepoi* - *Jalan Sepol* - …

The presentation of the questionnaires to the respondents were then instructed to attract the addressees' confidence. They were trained to use the expressions to clarify the followings; who we are, what our grade and fields of study are, what the title of the

research is and what the main concern of the research is, what the objective(s) of the research are, who the participant samples are, how you are selected as a respondent, in which manner , how the co-operation/participation in this research is and how much time it is needed , in case of agreement, the questionnaire would be asked as an interview or it would be submitted to the respondent(s) to reply personally.

The interviewers were also instructed how to react in case of questioning on the availability to this information on the research methodology and other concerning issues.

4.8. Survey Questionnaire

The questionnaire "are formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives" (Sekaran, 2000, p. 233).Survey questionnaire is an effective tool in collecting data from samples.

In current research, a covering letter from university of Malaysia was attached to the questionnaires, which explained to respondents that the research was being conducted to investigate their opinion about acceptance of RE technology in Peninsular Malaysia.In this study, the survey questionnaire consisted of three main parts (see table 4.5). As noted by Janes (1990), for obtaining higher respondents rate, questionnaire should start with the most important questions. Bourque and Fielder (2003) also mentioned "If demographic questions appear too early, respondents may come to be disaffected to comment".

Table 4.5: questionnaire contents

Questionnaire	Content
Part one	Questions about background information related to climate change and RE
Part two	Questions about constructs in the research model
Part three	Questions about demographic data

To inspire the respondents, the questions in the questionnaire were simple, unambiguous, and easy to read. Following the recommendation of Aaker et al. (1998), the questionnaire was organized to represent the objective of the study and number of steps was used in the questionnaire development process including: setting up clear objective, integrate results from prior research, comparing questionnaire design with previous study, collecting experts' comments and conducting pertest.

To establish validity and reliability a draft of questionnaire was checked with a number of experts in the field of RE (Frazer & Lawley, 2000). Furthermore, previous research studies and proposed hypothesis of this study were employed to develop survey questionnaire. The fundamental of survey questionnaire was established on the recommended guidelines for better response outcomes, the hypotheses of this study, and research questions.

4.8.1 Scale Development

Nominal and ordinal (Likert) scales are used in this study. For determining participants' demographic characteristics, such as gender, nominal scales are used, while to explore respondents' opinions regarding the acceptance of renewable energy Likert scales were employed. Table 4.6 presents details about the scales. A five-point attitude rating scale was developed by Rensis Likert in 1932. The five-point is selected because it has been applied in many TAM studies (Moon and Kim, 2001), it is also selected for this research.

4.8.2 Questionnaire Translation and Back Translation

It is a widely held view that translation of questionnaires is necessary because of cultural differences (Salciuviene et al., 2005; temple, 1997). "The most common reason for translating questionnaires is to be able to field an instrument not available in the language required for fielding" (Harkness and Schoua, 1998, p.87).Thus, in current study,

after organizing questionnaire (English version), it was translated into Bahasa Malaya. A bilingual translator with high fluency in both languages Bahasa Malaya and English translated the questionnaire to Bahasa Malaya (See appendix A).

4.9 Pre-test

According to Zikmund (2003, p. 229) pre-test is defined as a "trial run with a group of respondents used to screen out problems in the instructions or design of a questionnaire". Preferably, the instrument should be pre tested in the manner intended for the final study; self-administered survey questionnaire and interview schedules should be pre tested in the appropriate manner.

"Pre-test that is an essential and vital part in the translation process, would be done before translation.

Testing translated questionnaires should be carried out as meticulously as the designed questionnaires for one context, for both of the testing monolingual questionnaires and testing translated questionnaires, most of the techniques are equally relevant. . (Harkness, 2003, p. 41).The researcher needs to ask, "Will the instrument provide data of sufficient quality and quantity to satisfy the objectives of the research?" (Hunt et al., 1982, p. 270).

Since researcher is concerned about the utility of set of questions which is used in this thesis, 40 academic members and PhD candidates in university of Malaya disseminated the questionnaires to conduct the pre-test. After processing pre-test vague questions were eliminated or elucidated. Thus, the whole questionnaire was reviewed and necessary change have been made.

Table 4.6: hypotheses, variables and scale development

	Objective	Construct	Hypothesis	Scale	Relevant Questions
1	Classify respondents' demographic profile			Nominal	Income Age Gender
2	Determine respondents' attitude toward using renewable energy	Attitude toward using renewable energy (AT)		Likert 5 points	Q8-I intend to use renewable energy technology as often as necessary. Q9-I intend to continue using renewable energy in the future. Q10-Assuming I have access to renewable energy technology, I intend to use it. Q11-I will strongly recommend that others use renewable energy technology.
3	Investigate opinions on renewable energy acceptance	Perceived usefulness (PU)	PU → AT	Likert 5 points	Q12-Renewable energy technology improves the quality of daily life for the public at home. Q13-Renewable energy technology makes it easier to protect the environment. Q14-Continuous use of renewable energy technology enables me to reduce my electricity costs. Q15-Using renewable energy technology enhances the effectiveness of using energy.
4	Investigate opinions on renewable energy acceptance	Perceived ease of use (PEOU)	PEOU → AT PEOU → PU	Likert 5 points	Q16-Learning to operate renewable energy is easy for me. Q17-I find renewable energy technology flexible to interact with. Q18-It is easy for me to become skilful at using renewable energy technology. Q19-Overall, I find renewable energy technology easy to use.
5	Investigate the influence of external variables on TAM's core hypothesis	Cost (C)	Cost → PEOU Cost → PU	Likert 5 points	Q20-I find that renewable energy products are more expensive. Q21-I find the purchase of renewable energy products a good investment for future generations. Q22-I find that renewable energy products are more expensive compared with other product brands. Q23-I think that renewable energy products should be cheaper price to encourage their purchase.
6	Investigate the influence of external variables on TAM's core hypothesis	Knowledge (K)	K → PEOU K → PU	Likert 5 points	Q24-I think that the weather has become warmer in Malaysia. Q25-I think that the level of consciousness and knowledge amongst Malaysians regarding climate change should be increased. Q26-Excessive burning of fossil fuel is the main reason for climate change. Q27-The excessive use of natural resources (such as water and air) is the reason for climate change.

4.10 Pilot Study

The researcher should continually be on the alert for implications of the pretesting on one aspect for other aspects and work to interrelate all. Thus, the best method of insuring such interrelation is to conduct a pilot study. The pilot study is different from the final study only in scale. Unlike a pre-test, a pilot study should be directed at representative sample of the target population. For conducting pilot study, researcher conducted survey in city of Kuala Lumpur. This city is chosen because of two reasons; first Kuala Lumpur is one of the selected cities in stratification and second the researcher lived in this city so that conducting survey is easier.

Totally, 120 questionnaires were distributed in the five selected points in Kuala Lumpur. Out of 120 questionnaires, 89 questionnaires were returned (response rate of 74%). Pilot study was occurred from 8 June 2014 to 6 July 2014 (one month). After finishing pilot study, questionnaire is coded, transferred and analyzed exactly as planned for the final research.

4.11 Data Analysis Methods

Coorley (1978, p. 13) defines data analysis method as "the purpose of the statistical procedures is to assist in establishing the plausibility of the theoretical model and to estimate the degree to which the various explanatory variables seem to be influencing the dependent variable". In this dissertation, to analysis primary data Statistical Package for Social Sciences (SPSS) version 19 and in order to evaluate hypothesis model and relationship between variables structure equation model (SEM) were used.

4.11.1 Preliminary Data Analysis

Because Statistical Package for Social Sciences (SPSS) has been commonly used and accepted as data analysis technique (Zikmund, 2003), The attained quantitative data from questionnaires were analyzed by applying SPSS version 19.

Data coding, testing and finding out the data normality, identification of outliners, and treatment of missing data in this research have been screened by this tool. (i.e. using kurtosis and skewness statistics).

4.12 Structural Equation Modelling (SEM)

"Latent variables analysis involves the study of "hidden" variables that are not measured directly but that are estimated by variables that can be measured" (Bentler, 1995, p.213). "Latent factors is identified by the variance that is shared among the measured variables; it is the "true" variables that affects the measured variables (Hoyle, 1995b.p.43).To analyses the inter-relationships among variables in a model, a second generation statistical analysis technique called the Structural Equation Modelling (SEM) is developed. (Lei & Wu, 2007).

General statistical procedures for multi equation systems which contain continuous latent variables, errors of measurement, observed variables, errors in questions, and multiple indicators of concepts could be discussed by structural equation models. Having several "components" is a characteristic of analyzing by the use of structural equation models (Bollen & Long, 1993).

Structural equation modelling has become a popular research tool in the social science, economics, behavioral science, marketing, education and environmental area (Raykov, 2004). The forte of SEM is its capacity in assessing several kinds of relationships among variables simultaneously, testing and comparing difference and similarities between two or more groups of study participants rigorously, and examining the hypothesized relations among latent and manifest variables.

SEM could also afford a series of indices. These indices are to the extent which the specified models seems to fit the observed data. In various areas of science structural

equation modelling is totally an applicable tool. Structural equation modelling is applied in different areas of science (Hox & Bechger, 1998).It is a comprehensive statistical method of testing hypotheses on relations among observed and latent variables (Hoyle, 1995). It is used to represent, estimate, and test a theoretical hypothesis.

Environmental science researchers are often interested in studying theoretical constructs that cannot be observed directly. Latent constructs are measured applying a set of items in a questionnaire. Researchers are often dealing with these latent constructs. As Byrine (2003) says, because latent variable could not be observed directly, each of them should be linked to one that is possible, and after that the measurement of latent variable is possible.To conduct SEM, there are several programs and software including AMOS, EQS and LISREL (Raykov and Marcoulides, 2012).

Even though these software have to some extent similar capabilities, as newest software developed for SEM, in this study researcher employed AMOS (acronym for Analysis of Moments Structures) graphic to model and analyses the inter-relationships among latent constructs effectively, accurately, and efficiently.

In Structural equation modelling theory plays a vital role. The researcher begins by specifying a theoretical model on the basis of theory. Every construct in the model is conceptualized as a latent, and the researcher is measuring these constructs using multiple items in a questionnaire.

The diagram shows the hypotheses of interest. The constructs of interest are measured using a set of items in a questionnaire. The measurement scale for each item should be either interval or ratio. The variables in an SEM might affect each other reciprocally, either directly or via other variables as intermediaries (Fox, 2002). According to Kline (2005),

Two objectives of SEM are as follow: first, to define the patterns of correlation/covariance among a set of variables; second, to define their variances with the model as much as possible.

Accounting for variation and covariation in the model is the target of the model. The models and the relationship among variables are examined by path analysis and the relationships between latent variables are examined by implanting confirmatory factor.

It is necessary here to be explicit about exactly what is meant by latent, observed, dependent, independent, exogenous and endogenous variables. Whereas latent refers to the variables that are "hypothetically existing constructs of interest in study", observed variables "are the variables that are actually measured or recorded on a sample of subjects. The main characteristic of latent variables is that they cannot be measured directly, because they are not directly observable" (Raykov and Marcoulides, 2012, p. 49). There is another category for variables.Dependent variables are received one way arrow (at least one path) and independent variables are arises path.

It is important to note that exogenous and endogenous variables are also used for independent and dependent variables, correspondingly. SEM also is a powerful technique to run the Confirmatory Factor Analysis (CFA).According to Hattie and Fraser (1988) CFA referred to as restricted factor analysis. However, to examine hypothesis about the relation between a set of variables CFA could be used as the sole statistical strategy.

4.12.1 Sample Size in SEM

There are endless discussions in the literatures about the number of respondents that should be obtained in order to apply SEM. For example, Anderson and Gerbing (1984) mentioned that a sample size as small as 50 is required. Hair et al. (1995) explained that the minimum sample size for employing SEM is 100. However, Bentler (1995) argued

that the number of subjects used to estimate the parameters in SEM must be considered.Heir et al. (2010) noted sample size depends on the basic measurement model and the complexity of model. This research study followed Hair et al. (2010) assumption concerning the sample size.

4.12.2 Normality

In addition to sample size, it is necessary to examine the normality assessment for the data before proceeding to other steps. These issues would be argued in the following chapter in section (5.7.1)

4.12.3 Path Diagram

In SEM the theoretical framework could be converted into AMOS graphic and analyzed directly. The easiest way for communicating an SEM is drawing a diagram, known as 'path diagram.

"A 'path diagram' is representing a model in a graphic form. It is the same as a set of equations that defines a model and usually is utilized as an alternative to hand out a model pictorially. These diagram paths not only are a considerable help for perceiving SEM, but also in creation of correct command file for fitting and testing models with specific programs." (Raykov, 2000, p560). According to Arbuckle (2007) path diagram shows a specific SEM model that is actually the graphical equivalent of its mathematical representation.The path diagram in this study which is contained of the unobserved variables, measured variables, measurement errors, and arrows representing relationships between the variables is shown in figure 4.5.In path diagram, the observed variables are represented using rectangles; circles (or ellipses) represent unobserved latent factors; single-headed arrows (→) represent the impact of one variable on another; and double-headed arrows (↔) represent correlations between variables.

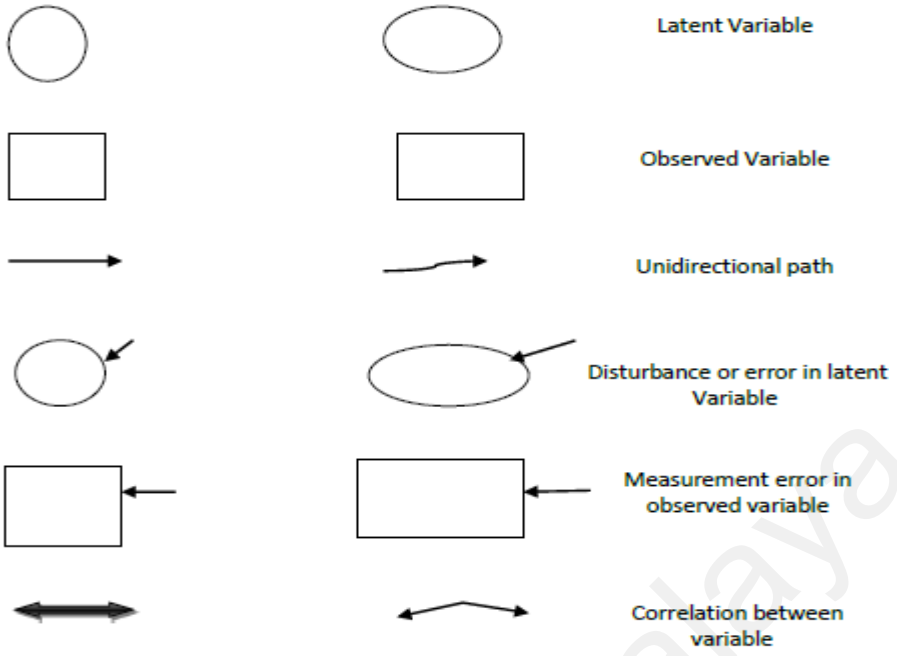

Figure 4.6: Symbols used in path diagram

4.12.4 Evaluating the Fit of the Model

One particularly important issue in SEM is determining how well the sample data fit the theoretical model. In other words, how well the obtained sample data support the theoretical model? As recommended by Byrne (2001), coefficient parameter estimates and goodness-of-fit indices determine SEM model fit.Evaluation of fitting of the data to hypothesized model should be done as soon as the model has been specified and the data have been entered.According to Hair et al., (1998) Structural equation modelling (SEM) has three main types of fit measure indices: absolute fit indices, incremental fit indices, and parsimonious fit indices.

4.12.4.1 Absolute Fit Indices

As McDonald and Ho (2002) reported, absolute fit indices determine how well a priori model fits the sample data. These measures offer essential indications of how well the proposed theory fits the data; they include the chi-square test, RMSEA, and GFI (Hooper, & Mullen, 2008).

The inferential goodness-of-fit index as well as a number of other descriptive or alternative indices would typically carry out the chi-square value evaluation. This inferential index is the so-called 'chi-square value'.

The index "represents a test statistic of the goodness of fit of the model and is used when testing the null hypothesis that the model fits the corresponding population covariance matrix perfectly" (Raykov & Marcoulides, 2006, p.467).

The best measure of general fit is chi-square (x2) (Bollen, 1989)In this study Goodness-of-fit index (GFI) is the second used absolute fit index measure.Joreskog and Sorbom (1981) suggested GFI for calculating the proportion of variance. It is accounted for estimated population covariance. The range of GFI value is between 0 and 1. Values of 0.9 or grater of GFI show well-fitting models. Root mean square error of approximation (RMSEA) is the third measure of absolute fit index.

The tendency of the chi-square to reject specified models could be corrected by using this measure. The recommended range for RMSEA is between 0.5 and 0.8. (Hair et al., 1995, p87)

4.12.4.2 Incremental Fit Indices

Incremental fit measure is contained in the second group of indices. The chi-square in its raw form is not used in these measures, chi-square value is compared to a baseline model (Miles and Shevlin 2007). A comparison between the proposed model and the null model is conducted applying these indexes. NFI or the Normal Fit Index is an incremental index. Comparing the x2 value of the null model and x2 value of the model is the way that NFI uses to assess the model. Referring to Bentler and Bonnet (1980) NFI ranges between 0 and 1, while values greater than 0.9 indicate a good fit. A recommendation of another study is that the cut-off criteria should be NFI≥. .95 (Hu & Bentler, 1999).

Another index in this study is the Comparative Fit Index (CFI). like the NFI, the range of CFI is between 0 and 1. A CFI value closer to 1 indicated a good fit. Furthermore, a cut-off criterion of CFI≥ 0.90 demonstrates a good fit (Hu & Bentler, 1999).

4.12.4.3 Parsimonious Fit Indices

As Preacher, K. J. 92006) noted parsimony refers to the degree of falsifiability, the capacity of a model to be empirically disconfirmed. It is important to know that a model is potent to be disconfirmed by the inconsistency between data and theory (Popper, 1959), else in the form of risky tests, a theory could not be truthfully subjected to scientific scrutiny. In the literature, the normed chi-square (x2 /df) tends to be used as popular parsimonious fit index (Hair et al., 1995).

A generally accepted values for the x^2 /df ratio have been suggested, ranging from less than 2.0 ,through less than 3.0 and lees than five (Bollen, 1989; Carmines & McIver, 1981; Wheaton et al., 1977). In combination with additional measures, current research has used less than five criteria for evaluating this measure. It is worth mentioning that, according to Hair et aI. (1996) one could ignore the absolute index of minimum discrepancy chi-square if the sample size obtained for the study is greater than 200.Summary of goodness of fit in SEM presented in table 4. 7.

Table 4. 7: Goodness of Fit Statistics in SEM for each category

Name of category	Name of index	Level of acceptance	Comments
1. Absolute fit	Chisq	P> 0.05	Sensitive to sample size >200
	RMSEA	RMSEA< 0.08	Range 0.05 to 0.1 is acceptable
	GFI	GFI > 0.90	GFI > 0.90
2.Incremental fit	CFI	CFI > 0.90	CFI = 0.95 is a good fit
	NFI	NFl> 0.90	NFl = 0.95 is a good fit
3.Parsimonious fit	Chisq/df	Chi square/ df < 5.0	The value should be less than 5.0.

Source: Hair et aI. (1996)

As explained earlier, in SEM, There are various fitness indexes to reveal how fit the model is to the data. Even though, about this matter that which one of the indexes should be reported, there is not an agreement in the literature.

For instance, Kline (1998) argues that providing an overall picture of model fit requires four indexes – GFI, NFI or CFI, SRMR, and NNFI. Using at least one fitness index from each category of model fit is recommended by Hair et al. (1995, 2010) and Holmes & Smith (2006). It should be noted, after measurement model is evaluated by goodness of fit criteria,to test hypothesis of the research besides the overall model fit indices, coefficient parameter estimates will be examined. A statistically significant parameter ($P< 0.05$) would cause a Critical Ratio (C.R.) which is greater than 1.96 for a regression weight. The result of this condition is significant and hypothesis is supported(Hair et al., 1995, Kline, 2005).

4.13. Two-stage SEM

There are two approaches to perform SEM. In the first method for every latent construct CFA procedure is to run separately. In the second, the CFA procedure is run simultaneously for all constructs. In both methods, the researchers need to assess the measurement model for unidimensionality, validity, and reliability requirements before modelling the structural model (Cheung & Chan, 2005). In two-stage model, all of the measurement models are combined together, plus that on all constructs the CFA is accomplished promptly.

In case in a research there are fewer than four items for each construct this model could resolve the issue of model identification. Figure 4.6 illustrates steps in two-stage model.

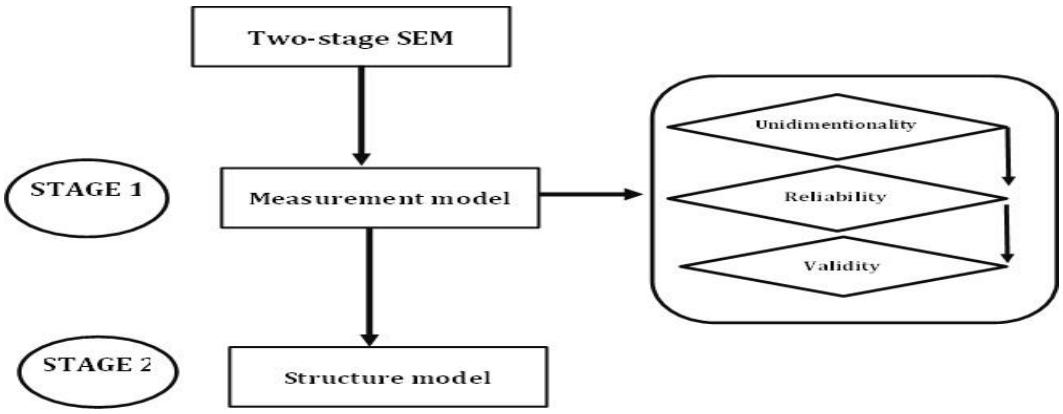

Figure 4.7: Steps in SEM two-stage mode
Source : Cheung and Chan (2005)

This ability is the reason why this method is preferred. Obviously, in a two-stage model SEM careful forethought is crucial.

The primary step is to boost a theoretical model, after that the variables were utilized as indicators of the latent variables could be added to the model. This part of the model is called measurement model which determines the relation between the observed and latent variables.

This contains two steps: the first is to assess unidimensionality, and the second is to assess validity and reliability. It is necessary here to clarify exactly what is meant by unidimentionality. unidimentionality refer to "an assumption underlying the calculation of reliability and is demonstrated when the indicators of a construct have acceptable fit on a single-factor (one dimensional) model" (Hair et al.,1995,p. 641).

Anderson and Gerbing (1988) indicated that when the factor loadings of the respective latent construct for the measuring items are acceptable Unidimensionality is achieved. The goal of this test is to make sure that a set of elements measures a single dimension empirically. The factor loading for an item should be 0.5 or higher. It must be noted that Unidimensionality of each construct has to be examined before the examination of reliability and validity. To confirm unidimensionality of a measurement model all of the

items with a low factor loading have to be eliminated. After achieving unidimensionality for each construct, the second step would be validity and reliability tests of these constructs.

The next step in the process after establishing the equivalence of the measurement model, is to examine the invariance related to the structural portion of the model. The structural part of a model specifies the relationships among the latent variables, and the measurement part specifies the relationship of the latent to the observed variables.

As Hair et al. (2006) noted whenever the assessment of measurement model was accomplished based on the results of unidimensionality, reliability, and validity tests, the structural model could be examined as a second stage to test the hypothesised relations in the proposed model.

For every proposed model, a structural model is a section of the whole structural equation model diagram that should be completed. Ever variable that is necessary to be accounted for in the model including latent and manifest would be related by applying a structural model. To provide a structural model there are a few vital rules to follow. According to Arbuckle (2005) a structural model is the model that demonstrates how the latent variable are related to each other. The structural model demonstrates the interrelationships among constructs in the study. The constructs are assembled into the structural model based on the hypotheses stated in the theoretical framework.

4.14 Reliability and Validity

After measuring unidimensionality, the underlying constructs can be assessed for reliability and validity. As Bollen (1989) pointed out, reliability and validity are separate but closely related concepts. Thus, to ensure the quality of the findings in this thesis, both validity and reliability are assessed.

Cronbach's (1951) coefficient alpha, average variance extracted (AVE), and construct reliability (CR) are calculated to evaluate reliability, on the other hand construct, content, criterion and external validity are assessed for validity. Both reliability and validity assessments are discussed below.

4.14.1 Reliability

Reliability is defined as the "degree to which measures are free from random error and therefore yield consistent results" (Zikmund, 2003, p. 330).

Yin (1994) pointed out the substantial objective of reliability in a research is reducing the errors and bias as much as possible. According to Punch (1998) the error and reliability have indirect ratio, the higher the reliability, the smaller the error. In the current research, based on Nunally (1978) comments the reliability of the measurement items is estimated by scrutinizing the consistency of the respondents' answers to all of the items of the questions in the measure.

Cronbach's (1951) coefficient alpha, Construct reliability (CR), and Average Variance Extracted (AVE) are calculated to evaluate reliability. The good amount of Cronbach's alpha value is 0.7 and higher (Sekaran, 2000).

This coefficient is used to assess internal reliability. Fornell and Larcker also recommended examining of Construct Reliability (CR) and Average Variance Extracted (AVE) as well.

According to Holmes-Smith et al (2006) rather than the reliability of a single variable, CR measures the composite reliability of a set of measures. Bagozzi and Yi (1988) recommended that "CR should be equal to or greater than .60, and AVE should be equal to or greater than .50(p. 28). As this threshold is widely accepted, it has been used in this thesis"

Table4.8: Fit indices for the substantive model

Criteria	Level of acceptance	Technique for calculation
Cronbach's Alpha	higher than 0.7	Calculated in SPSS
Construct Reliability (CR)	> 0.6	Using the given formula in page
Average Variance Extracted (AVE)	> 0.5	Using the given formula in page

Source: Bagozzi and Yi (1988)

4.14.2 Validity

As Zikmund (2003, p. 331) mentioned, "Validity means the 'ability of a scale to measure what is intended to be measured. There is a direct ration between the quality of fitting among the operational and conceptual definitions and measurement validity. The better fitting the greater measurement validity. The capability of an instrument to assess what is needed to be measured for a construct is known as validity.Three types of validity are required for each measurement model:

1. Convergent validity is the extent that observed variables of a particular construct share a high portion of the variance in common (Hair et al., 2006). Validity is attained when all objects in a measurement model are statistically significant. To assess the convergent validity average variance extracted (AVE) could also be implemented. To have an adequate convergent validity, reliability estimates should be greater than 0.7 and estimation should be above 0.5 (Chandio , 2011. p.135)
2. Construct validity "refers more to the measurement of the variable. Construct validity is more concerned with the choice of the instrument and its ability to capture the latent variable" (Zait, 2011, P.98).When the fitness indexes for a construct accomplish the required level this validity is achieved.
3. Discriminant validity refers to the extent to which a latent construct is truthfully distinct from other latent constructs (Hair et al., 2006). "Discriminant validity

assumes that items should correlate higher among them than they correlate with other items from other constructs that are theoretically supposed not to correlate" (Zait, 2011, p.101).For attaining discriminant validity it is necessary to obtain appropriate AVE (Average Variance Extracted). Square root of every AVE for each construct has to be much larger than any correlation among any pair of latent constructs. To evaluate the discriminant validity of every single construct in this study the mentioned procedure was used." (Chandio, 2011.p119).Hair et al. (2006) also suggested that for discriminant validity the correlation between exogenous constructs should be less than 0.85.

In summery for achieving validity in SEM, there is a need to obtain required level for fitness indexes, correlation between exogenous constructs should be less than 0.85, AVE estimation should be greater than 0.5 and the square root of the AVE of each construct should be much larger than the correlation of the specific construct with any of the other constructs (Zait, 2011)

4.15 Qualitative Data Collection and Sample

As it is mentioned before, in current study, both quantitative and qualitative triangulations of data are used for further conceptual validation. The qualitative approach allows the researchers to attain deep knowledge about a given phenomenon and to develop a highly descriptive comprehension of the subject under study (Yin, 1994).

According to Cooper and Schindler (2001), purposive sampling is a non-probability sampling technique which is used in qualitative interviews. Because this type of sampling allows the researcher to collect rich cases to achieve information. (Patton, 1990). As this research explore the elements affect renewable energy technology acceptance in Peninsular Malaysia, having knowledge and expertise in

the field of climate change and renewable energy was considered as a major criteriona of selecting a sample.

Therefore, a series of semi-structured interviews were conducted with 35 experts in the field of renewable energy, including 18 academic staff members and 17 members of energy companies and civil society. As noted by Malhotra (1993), a significant list of concealed issues of research interest could be uncovered by the interviewer in semi-structured interview. In fact, this type of interview lets the interviewer to do so.

This additionally aids the research phenomena of interest to be explored. (Mathews, 2000).Academic staffs were chosen from the scholars of UM (University of Malaya). The reasons is because UM ranks first among all universities in Malaysia and this means that high quality scholars are working in this university.

4.15.1 Qualitative Interview

In this study among different qualitative technique, the used method was interviews (Appendix B).Pre-testing of the protocol included conducting and recording by two interviewers in university of Malaya. Some scholars revised these interviews.

There was no need to translate the protocol because qualitative data were gathered from qualified fluent importers/managers in English.

A semi-structured questionnaire along with a tape recorder was used as basic instruments for qualitative data collection. The interviewees will be presented with semi structured interviews. Before the conducting the interview, the propositions which is based on research objective has been selected. The propositions have been shaped the data collection plan and therefore (Yin, 1984).

4.15.2 Qualitative Data Analysis

In this study like any other qualitative study, the data collection and analysis occur concurrently. For analyzing data of this research, the researcher will rely on the theoretical framework.

According to Yin (1994) relying on theoretical propositions as a general strategy helps an investigator to choose among different techniques and complete the analytic phase of the research successfully.

It is important to notice that there are no cookbook procedures that have been agreed for the analysis of case study results, but for doing a good case study analysis one would adhere to the following principles: 1. using all of the relevant evidence 2. Considering all of the major rival interpretations, and exploring each of them in turn 3. Addressing the most significant aspect of the case study 4. Drawing on the researchers' prior expert knowledge in the area of study, but in an unbiased and objective manner (Rowley, 2002).Leximancer software which is a tool designed for analyzing natural language text data was employed in this study. This software lets user to analyses data without formulate a coding scheme.

4.16 conclusion

This chapter justifies appropriate methodology which is used in this thesis to address the research objectives. Previous studies were the base to develop questionnaire and measurement scales. The instrument and methods implemented to collect the data have been discussed. In addition, applied techniques to examine the research hypotheses of the proposed model like target population, sampling and statistical techniques have been described. Moreover, other issues related to methodology like validity and reliability also have been explained. The results obtained in this thesis are described in the next chapter.

CHAPTER 5: DATA ANALYSIS AND RESULTS

5.1. Introduction

The purpose of this chapter is to present the results of the data analysis, which is divided into eleven sections. Following the introduction, the next two section presents data editing and data screening. In the next section response rate is discussed and fifth section 5.5 presents characteristics of respondents. The six section 5.6 report the results of public awareness about climate change and RE. The seventh section presents results from structural equation modelling analysis. Section 5.8 and 5.9 provide discussion about measurement model and structure model, respectively. The tenth section describes results of hypotheses tested in this thesis and a conclusion is presented in section 5.11.

5.2. Coding the data

In processing the data, it is essential to edit the data (Zikmund, 2003).With the regards to missing data, all the respondents who are not completed 75% or more of questionnaire were considered as missing values (Kinner and Taylor, 1996; Sekaran, 2000). SPSS coding was used to transfer data from questionnaire and assign a number to each value (Malhotra, 1996). This process can be performed both before and after questionnaire as pre and post coding (DeVaus, 1995). In this study, all questions were pre-coded with numerical values by establishing a data file in SPSS. Out-of-range values in the data file were corrected by referring to the original questionnaire.

5.3. Data Screening

Data screening is critical to make sure that data have properly been entered and the distribution of variables is normal (Coakes, 2006). Therefore, in the first stage in the quantitative data analysis, screening for missing data and outliers was accompanied.

5.3.1. Missing Data

In the present report, missing data were defined in terms of failing to answer the survey questions (Coakes, 2006). It has been reported that there are two methods for evaluating the level of missing data (Tabachnick and Fidell, 2001); assess the amount of missing data and assess what data are missing. The later can be more essential since this method has an advantage in defining when missing data happen accidentally. This is to avoid the biased estimation of the result where the missing data are not distributed randomly (Tabachnick and Fidell, 2001).

After collecting the questionnaire, it was found that 26 respondents failed to provide complete answers to the items in the questionnaire. Several studies (Cohen and Cohen, 1983; Olinsky et al. 2003) have documented that if there are relatively few respondents with missing data (i.e. fewer than 5% or even 10% of missing data) and the pattern is ignorable, the researcher may decide to exclude them from the construction and analysis of the index. In current study 26 questionnaires had at least 20% or more questionnaire unanswered.

Table 5.1 presents the percentage of missing data. It can be seen that none of the items had more than 2% of the missing observations. This amount is very low and can be considered acceptable.

Since assessment of the randomness of the missing data (Hair et al., 1995) shows that there is no sign of pattern and only random occurrences, it can be concluded that there is no problem with the data (Tabachnick & Fidell, 2001; Byrne, 2001)). Due to the fact that the pattern of missing data was no specific and the amount of missing value was low, as suggested by Byrne (2001) regression imputation' technique to replace the missing data.

Table 5.1: Percentages of missing data

	Item	Missing values
Construct		%
Perceived usefulness	PU1	0.9
	PU2	0.8
	PU3	1.3
	PU4	1.0
	PU5	1.6
Perceived Ease of Use	PEO	0.9
	PEO	0.6
	PEO	0.7
	PEO	0.4
	PEO	1.3
	PEO	0.9
Attitude	T1	1.0
	T2	1.3
	T3	1.3
	T4	0.8
	T5	1.6
Cost	C1	1.6
	C2	0.5
	C3	0.0
	C4	0.2
	C5	0.0
Knowledge	K1	0.3
	K2	0.6
	K3	0.9
	K4	0.8

5.4. Response Rate

In this dissertation, response rate refers to "the percentage of people who respond to a survey, this rate is important and should not be left to chance" (Groves, 1990, p.314). As far as representativeness of the target population is concerned, high response rate is necessary.

According to Punch (2003) "acceptable response rates for face to face survey is between 80-85%".Therefore, the response rate of the current study is considered appropriate. It is necessary to note that the bating sample is large enough to conduct SEM analysis.

63 surveys were thrown away and the number of remaining feasible completed questionnaires were 784 out of 850. This number demonstrated a rate of 92%. The ultimate number of 784 samples were recognized as representing public in Peninsular Malaysia.

5.5. Sample Characteristics

With respect to sample characteristics, various variables have been used to describe it.

Table 5.2: Sample characteristics

Demographic Profile	Number of Respondents (N=784)	Valid Percentage (%)
Gender		
Male	443	56.5
Female	341	43.5
Age		
21 - 30	399	51
31 - 40	174	22
41 - 50	109	14
51 - 60	77	10
61 above	25	3
Ethnic groups		
Malaysian	533	68
Chines	188	24
Indian	63	8
Monthly Income		
RM1000 & below	141	18
RM1001 - RM2000	220	28
RM2001 - RM3000	148	19
RM3001 - RM4000	110	14
RM4001 - RM5000	78	10
RM5001 & above	87	11
Marital Status		
Single	384	49
married	337	43
Divorced/ widow	63	8

Table 5.2 provides a summary data for respondents' demographics involving gender, age, income and educational qualification. Table 5.2 indicates that approximately 56% of the respondents were male. Most of the respondents (75%) were between 20 and 40 years of age.

5.6. Public awareness about climate change and RE technology

5.6.1. How much have Malaysians concern about climate change?

The survey respondents were asked how concerned they were about climate change. "This is one of the most frequently used methods of gauging the extent to which climate change is seen as an issue to people on a more personal level." (Capstick et al, 2015).Around two thirds (69%) of the national samples stated that they were concerned about climate change (fairly or very). In the states level, data shows that level of public concern about climate change in central region is significantly higher than the average of peninsular Malaysia (79%), while in the east coast (71%) and north (68%) this figure is almost near the average of peninsular Malaysia. On the contrary, in the south region the data shows that 61% of the survey respondents have heard about global warming which is considerably less than the other regions and average. (Figure 5.1)

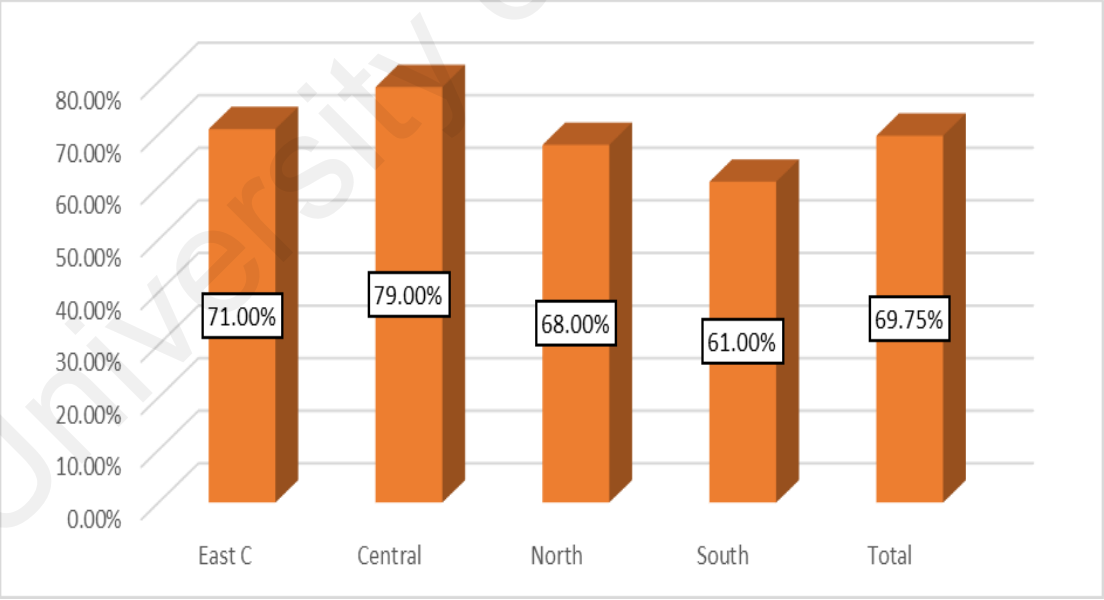

Figure 5.1: Level of concern about climate change in Malaysia

5.6.2. Climate Change Associations

"When you think of climate change, what is the first word or phrase that comes to your mind?" this is the next question which was asked from respondents. The results of

this study showed that the term "climate change" more elicits association with weather and rain. Over three-quarters of respondents (77%) believed that the term "climate change" more evokes association with weather and 68% believed that "climate change" refers to rain. (See figure 5.2)

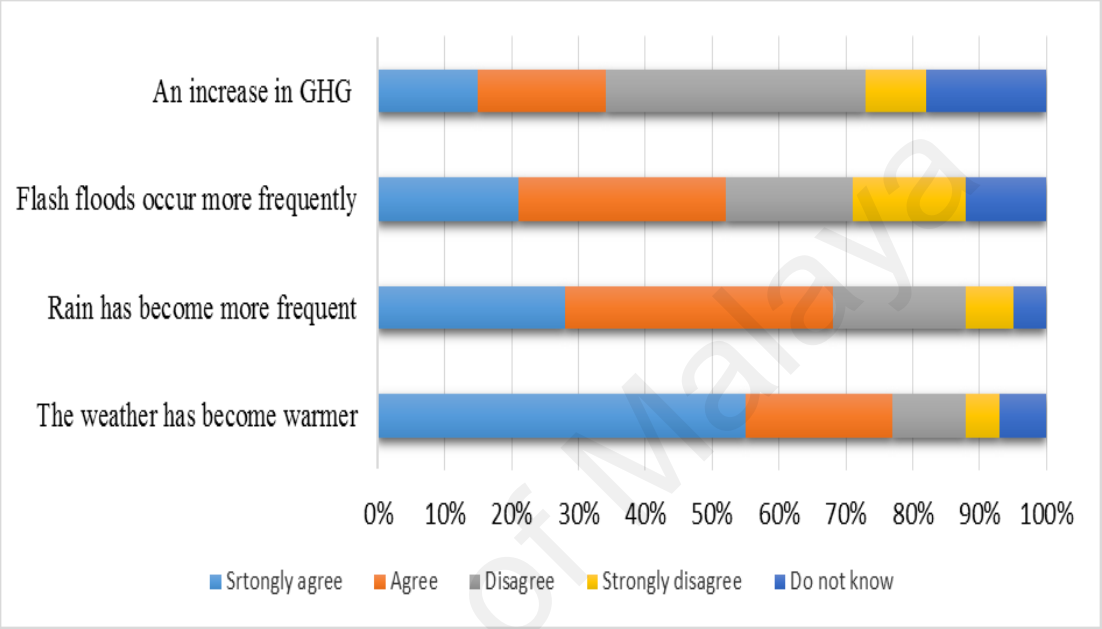

Figure. 5.2: Climate change associations.

5.6.3. What Causes Climate Change?

Respondents then asked to give their opinion about factors that cause climate change by choosing from a list of topics. Analyzing the data indicated that 81% of respondents assume that the main cause of climate change is a human activity; while 19% think that natural processes alone are a cause of climate change.

Among a list of four human activities, 32 % of respondents think climate change is caused mostly by emissions from vehicles and motorcycles, 23 % believe that hazardous fumes from factories are a cause of climate change and 14% and 12% think that excessive burning of fossil fuel and excessive use of electricity are the main cause of climate change respectively (figure 5.3).

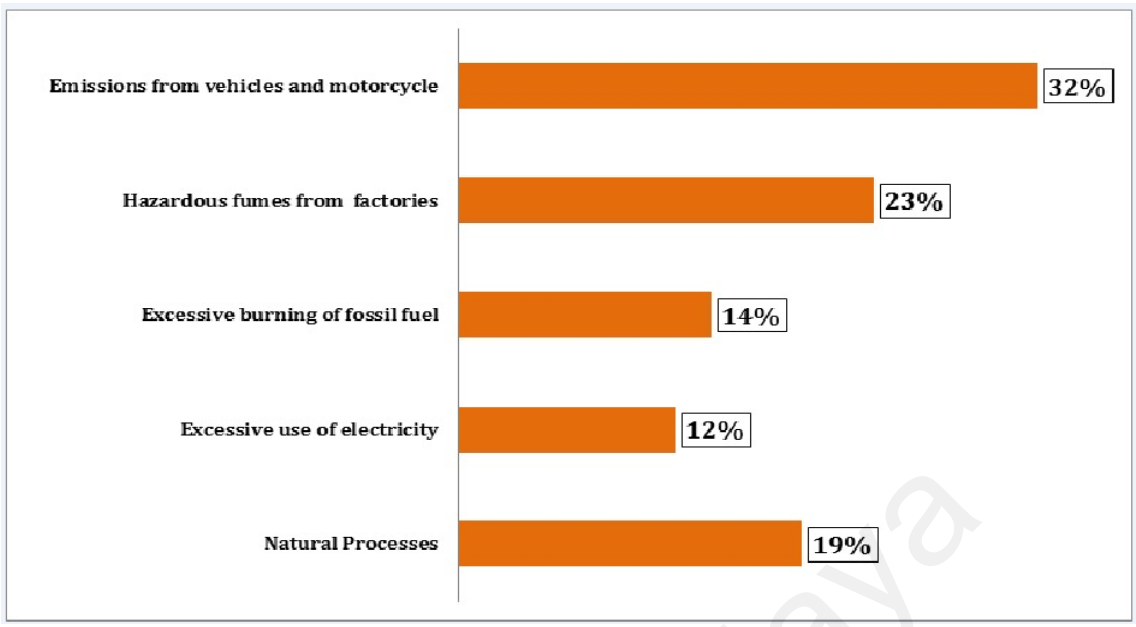

Figure 5.3: Cause of climate change

5.6.4. How much have Malaysians heard about green technology?

The analysis of the data shows that nearly three-quarters (76. %) of the respondents have heard about green technology products. However, only 42.50% ever used green products. These findings clearly showed that the respondents are aware of the green products on the market but still rarely use them. At regional level we see that the respondents in the central region are more likely to hear about green products (80%) followed by subjects in east coast (78%), north (77%) and south (72.80%). (Figure 5.4)

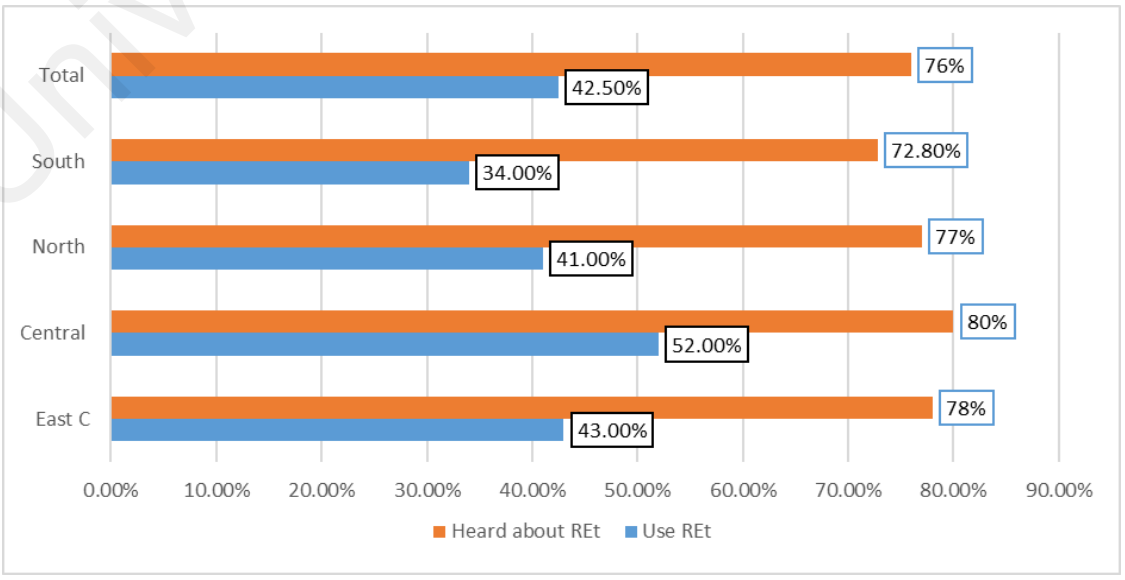

Figure 5.4: Heard about RE & use RE

5.6.5. Public awareness about the concept of green technology

Table 5.3 shows the level of public awareness about the concept of green technology is high (above 3.8 mean), which involves the level of security and improvement of environmental quality, energy conservation and environmental resources and promoting the use of renewable energy. Level of public awareness about the concept of green gas emissions are low or zero (mean = 3.3) and needs to be improved. Efforts to enhance public awareness of green technology to minimize environmental degradation (mean = 3.8) also needs to be improved. Public awareness about the development and application of products, equipment and systems to preserve the environment and natural resources that can minimize and mitigate the negative result of human activity should also be enriched.

Table 5.3: Awareness about the concept of green technology

Awareness about the elements of green technology	**Mean**
conserve the natural environment and resources which minimize and reduces the negative impact of human activity	3.5
Minimizes degradation to the environment	3.8
has zero or low greenhouse gas emission	3.3
safe for used and promote healthy and improved environment for all forms of lives	3.9
conserve use of energy and natural resources	4.1
promotes the use of renewable resources	4.2
Total mean	3.8

5.6.6 Knowledge about REt initiative

Regarding the Knowledge of renewable energy technologies (REt) initiative undertaken by the government, only 57% of the respondents believed that they knew about the initiative (Fig. 5.5). At the regional level, the residents in the central region (61.6%) have heard more about this government initiative, while the subjects in the south have heard of it less (51.9%).

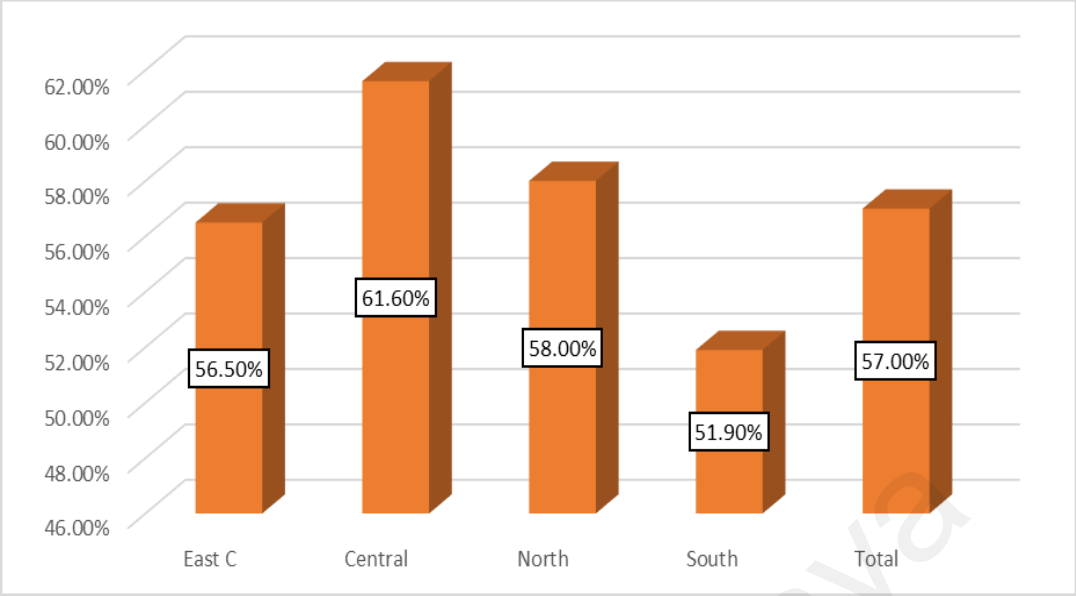

Figure 5.5: Government initiative about green technology

5.6.7. Knowledge about RE sources

In response to the question "To your knowledge, can the following resources be used as renewable energy sources?" The majority of the participants (90%) responded that sun and water can be considered as renewable energy resources. It means that sun and water technologies are the most acknowledged, while nuclear and geothermal remain the least recognized. Biomass, remains better known than wind power in these cases. (See figure 5.6).

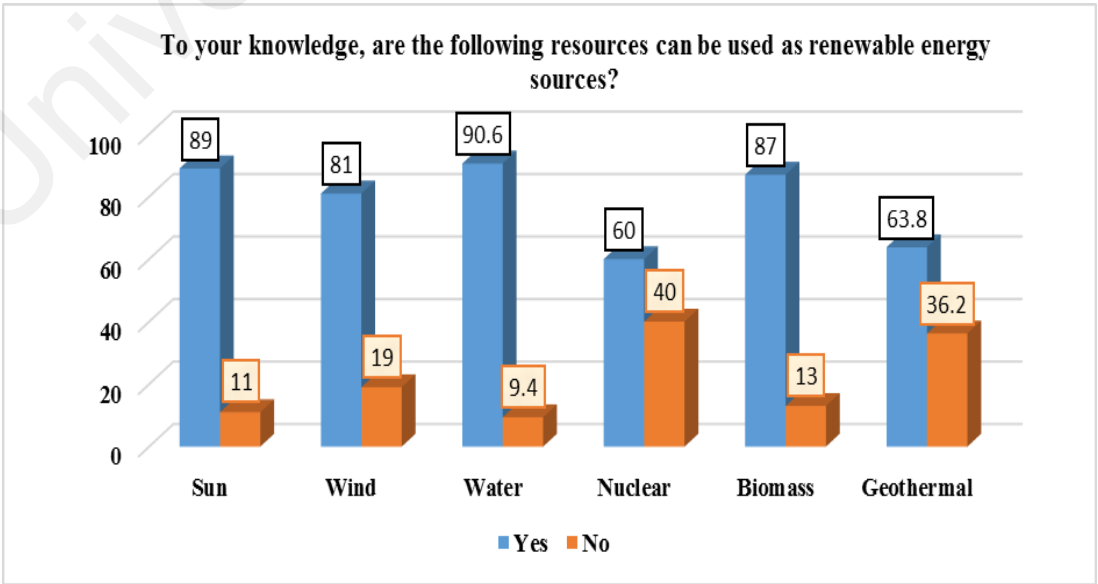

Figure 5.6: Knowledge about RE sources

5.6.8 Price of Renewable Energy Products

Most of the public believed that the price of renewable energy products was expensive (81%) (Fig. 5.7). At the regional level, a large number of respondents in the central region said that they think green products are expensive (84%), as did respondents in the north (81%), east coast (81%) and south (78%).

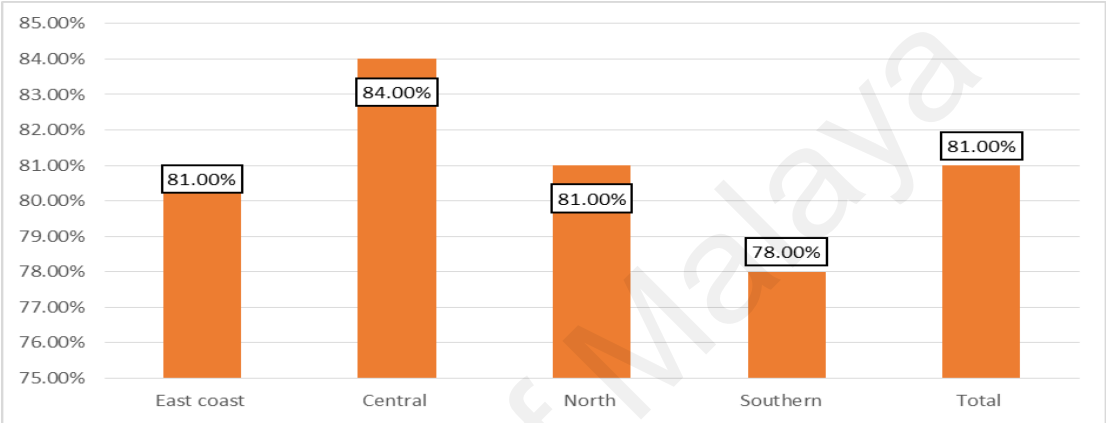

Fig 5.7: Perceptions about the price of green technology.

5.6.9 Environment Impact of RE

Almost three quarters of the participants (77.1%) said that they believed renewable energy products had a positive impact on the environment, while 22.9% disagreed that these kind of products had positive impact on the environment. (See figure 5.8).

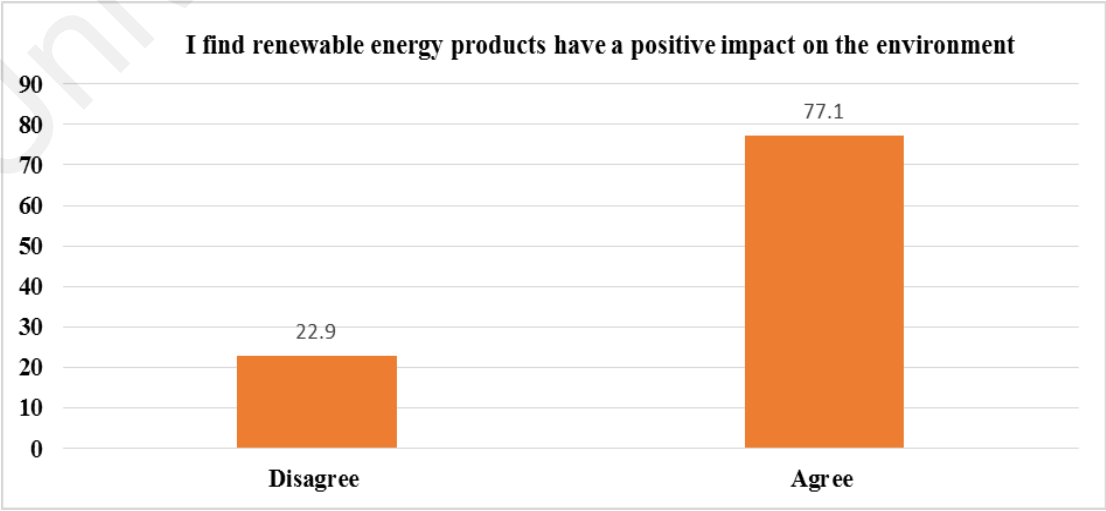

Figure 5.8: Environmental impact of RE

5.6.10 Policies/Programs initiated by the government

Table 5.4 shows that some of the policies that have been implemented by the government over the past few years to support the country's green technology policy. Based on this analysis, most of the respondents never heard of or did not know about the policies that have been implemented.

The data show that all the policies except the National Green Technology Policy (55.3%) and National Energy Master Plan (52.6%) are associated with a low percentage of knowledge (i.e. less than 50%).

The Sustainable Energy Development Authority Act of 2011 was the most unknown by the general public (38.6%), followed by the Framework for Low Carbon Cities (40.5%), the Renewable Energy Policy and National Action Plan of 2009 (42.1%) and the Investment Tax Exemption (43.1%). Other policies were associated with only slightly higher levels of knowledge.

Table 5.4: Awareness about the policies initiated by the government

Have you heard of the following policies initiated by the government	Percentage of respondents who answer yes
National Green Technology Policy	55.3%
National Renewable Energy Policy and Action Plan 2009	32.1%
Renewable Energy Act 2011	36.0%
Sustainable Energy Development Authority Act 2011	38.6%
Investment Tax Allowance (ITA)	43.1%
National Energy Master Plan	52.6%
Clean Development Mechanism (CDM)	44.2%
Electric Vehicle Infrastructure Roadmap	44.9%
Low Carbon City Framework	40.5%
Green Lane Policy for Innovative Malaysian, SMEs[a]	43.3%
National Land Public Transport Master Plan	47.4%
Feed-in-Tariff for Renewable Energy	39.1%
Low Energy Office (LEO) Building	42.1%
Green Building Index (in cooperation with the private sector)	46.9%

[a]SMEs, small and medium enterprises

5.6.11 Level of effectiveness of the policies

In another question, the public was asked whether in their point of view the policies and programs carried out by the government are successful or not. Over half of those surveyed (55.9%) believed that the policies were not successful, compared to 44.1% who said that they were successful. Hence, the public largely believes that the government's efforts did not succeed and these findings are consistent with a low level of knowledge about the existence of policies and programs that have been undertaken by the government.

Table 5.2, showed the results for a question in which the respondents were asked to provide a value for their perceived level of failure for government policies and programs, more than 68.5 % said that the level of government policies and programs failure was high (scale 3–5), i.e. at this scale, the policies and programs were judged to be not successful. Only 31.5% said that the failure rate was low (scale 1–2). These data clearly show that the majority of the public consider the government policies and programs as failures.

Table 5.5: Level of unsuccessfulness of policies

	Percentage (%)		Mean	Std.deviation
	Scale 1–2, Low Level	Scale 3-5 high level		
To what extent are policies/programs run by the government not successful?	31.5	68.5	3.0	0.389

5.6.11 Support for Renewable Energy

The vast majority of the public support renewable energy; 68% believe it is a 'good idea', compared to just 5% who disagree. The major conclusion that can be drawn from

these results is that the attitude of respondents is generally positive towards renewable energy technologies (See figure 5.9)

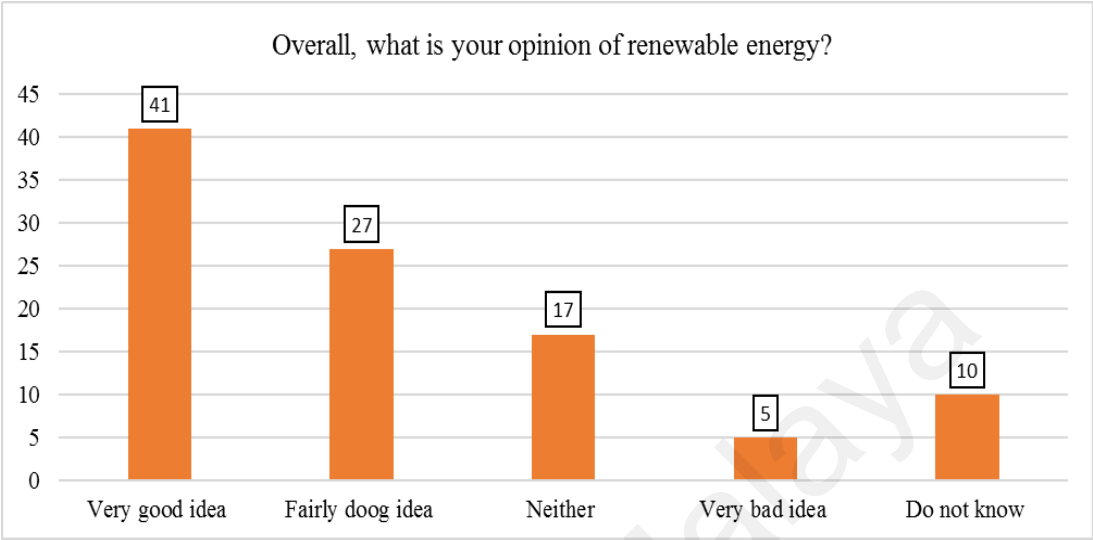

Figure 5.9: Support for renewable energy

5.7. Analysis and Results of SEM

As recommended by Anderson and Gerbing (1988) to test the hypotheses arising from the theoretical model in SEM a two-stage approach is applied. As explained in methodology chapter, the data analysis in SEM contains two steps (See figure 5.10)

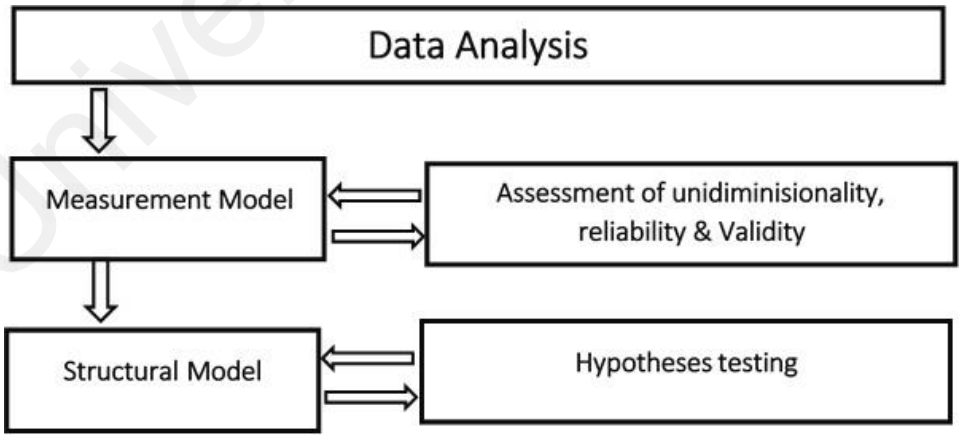

Figure 5. 10: Data analysis in SEM

To identify the relations between the underlying theoretical constructs and the measured items, in the first stage (measurement model), the confirmatory factor (CFA)

using AMOS 19.0 was executed. Relationships between the underlying exogenous and endogenous constructs would be stated in the structural model after evaluating validity and reliability. (Second stage). Cost and knowledge are exogenous constructs whereas endogenous constructs included perceived of usefulness, perceived ease of use and attitude toward using technology. The next would be the discussion of analysis and results related to these two stages.

5.7.1. Assessment of the Normality

One important assumption in SEM is that variables require to be normality distributed (Tabachnick & Fidell, 2001).

According to Hair et al (2006; p. 79) normality is refer to the "shape of the data distribution or an individual metric variable and its correspondence to the normal distribution, which is the benchmark for statistical methods". As it can be seen in table 5.6 normality check produces two indexes skewness and kurtosis.

"The skewness depicts the symmetry of distribution whereas the kurtosis refers to the measure of the heaviness of the tails in a distribution compared with the normal distribution" (Chandio, 2011.p.109).It has been reported that that if skewness and kurtosis are greater than (3.0) and (8.0) respectively, they will be considered extreme value, so that the normality assumption is rejected. (West et al. 1995, Kline, 2005).Subsequently, it is proposed that the amount for kurtosis and skewness should not be above ten and three.

Amos 19 is employed to examine both indices shows that the obtaining value were within acceptable level (See table 5.6**),** suggesting univariate normality. Since these variables did not deviate from normality, it was not necessary to make any adjustments such as transformation of the data (Tabachnick & Fidell, 2001).

Table 5.6: Normality of data

Items	Mean	SD	Skewness	Kurtosis
Attitude toward using renewable energy				
I intend to use renewable energy technology as often as necessary	4.94	1.74	.811	.341
I intend to continue using renewable energy in the future.	4.97	1.62	. -.800	-.129
Assuming I have access to renewable energy technology, I intend to use it.	4.67	1.68	-.526	-.524
I find the quality of renewable energy products is not as good as ordinary products				
I will strongly recommend that others use renewable energy technology.	5.00	1.70	-.766	-.334
Perceived usefulness (PU)				
Renewable energy technology improves the quality of daily life for the public at home	4.82	1.62	-.641	-.330
Renewable energy technology makes it easier to protect the environment.	5.26	1.35	-.685	.018
Continuous use of renewable energy technology enables me to reduce my electricity costs.	5.19	1.53	-.871	-.022
Using renewable energy technology enhances the effectiveness of using energy.	4.93	1.64	-.543	-.572
Perceived ease of use (PEOU)				
Learning to operate renewable energy is easy for me.	5.20	1.46	-.789	.388
I find it easy to make renewable energy technology do what I want it do.	5.11	1.63	-.828	-.043
I find renewable energy technology flexible to interact with	4.97	1.55	.-560	-.440
It is easy for me to become skilful at using renewable energy technology.	5.01	1.54	-.604	-.366
Overall, I find renewable energy technology easy to use.	4.84	1.53	-.484	-.577
Cost				
I find that renewable energy products are more expensive	5.08	1.51	-.765	.233
I find the purchase of renewable energy products a good investment for future	5.22	1.70	-.906	-.169
I find that renewable energy products are more expensive compared with other product brands.	4.94	1.50	-.788	-.184
I think that renewable energy products should be cheaper price to encourage their purchase.	5.60	1.50	-1.126	.558
Knowledge				
I think that the weather has become warmer in Malaysia	4.94	1.50	-.788	-.184
I think that the level of consciousness and knowledge amongst Malaysians regarding climate change should be increased.	5.25	1.46	-.715	-.051
Excessive burning of fossil fuel is the main reason for climate change.	5.50	1.23	-.628	-.109
The excessive use of natural resources (such as water and air) is the reason for climate change	5.53	1.39	-.796	.391
RE technology minimizes degradation to the environment.	5.30	1.40	-.729	.068

5.8. First Stage: Measurement Model

"The portion of the model that specifies how the observed variables depend on the unobserved, composite, or latent variables" (Arbuckle, 2005, p.89) is measure model. According to Anderson and Gerbing (1982, p. 453) "the reason for drawing a distinction between the measurement model and the structural model is that proper specification of the measurement model is necessary before assigned to the analysis of the structural model."

This point was echoed by Bagozzi (1981, p. 376), who mentioned that "convergence in measurement should be considered a criterion to apply before performing the causal analysis because it represents a condition that must be satisfied as a matter of logical necessity."As measurement model relates the constructs to their measure (Gerbing & Anderson 1988; Byrne, 1989).

All constructs in the model including cost, knowledge, PU, PEOU and attitude toward using technology was separately analyzed in a separate measurement model. Evaluating measurement model has been divided into two stages: measuring unidimensionality for each factor, and then assessing the reliability and validity of each construct.

5.8.1. Unidimensionality (stage 1)

The constructs in the proposed model including: external variables (cost and knowledge), perceived ease of use, perceived of usefulness and attitude toward using technology were assessed for unidimensionality in a separate measurement model.

According to Kline (2005, p.172) "in each measurement model at least three indicators are needed to identify model". Following Hair et al. (1995, 2010) and Holmes-Smith (2006) recommendation, current study uses of at least one fitness index from each category of model fit. As it is mentioned in chapter four (methodology) there are three

model fit categories namely absolute fit, incremental fit, and parsimonious fit. Jöreskog and Sörbom (1982) and Hair (1995) pointed out that that for each measurement model, it may some items seem to be redundant. It is necessary that the measurement model to be re- specified by eliminating the redundant items.

It has been suggested that acceptance of unidimensionality for each model needs two considerations. "Firstly, a relatively high-standardized loading on the factor (0.5 or upper) is totally necessary for indicators specified to measure a proposed underlying factor.Secondly, the measured correlations between the factors have to be less than or at most equal to 0.85." (Kline, 2005.p.88).

For example, if the estimated correlation between cost and knowledge in the measurement model of figure 5.12 is 0.92, thus it is possible that the items are not evaluating two distinct factors and an overlap exits between these two factors and therefore they are not practically distinguishable. As explained earlier, several fitness indexes has been used to report fit measures. It should be noted that there is no agreement in the literature about which fitness indexes should be used. This thesis follows Hair et al. (2010) and Holmes-Smith (2006) recommendation the use of at least one fitness index from each category of model fit (RMSEA, GFI, CFI, Chisq/df). (See figure 5.11)

Name of category	Name of index	Level of acceptance
1. Absolute fit	Chi-Square	P-value > 0.05
	RMSEA	RMSEA < 0.08
	GFI	GFI > 0.90
2. Incremental fit	AGFI	AGFI > 0.90
	CFI	CFI > 0.90
	TLI	TLI > 0.90
	NFI	NFI > 0.90
3. Parsimonious fit	**Chisq/df**	Chi-Suare/ df < 3.0

Figure 5.11: Measure fit for model evaluation
Source: Hair et al. (2010)

5.8.1.1. External variables

External variables were measured using two separate factors: cost and knowledge. Each of these factors has been measured by a number of questionnaire items (i.e., indictors). In total, 9 items were used to measure the external variables (see table 5.7) .

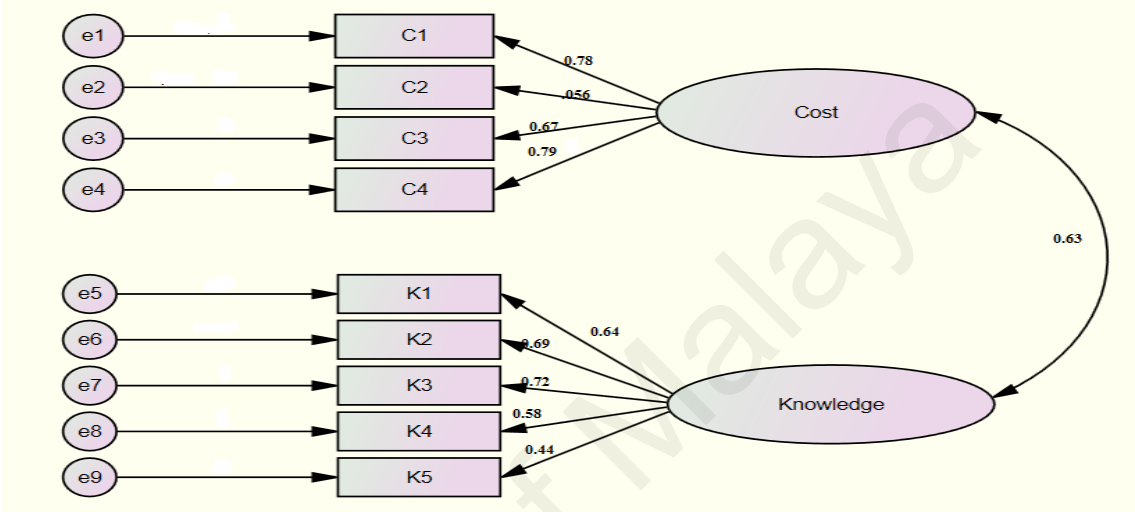

Figure 5.12: Measurement model of external variables

In figure 5.12 knowledge and cost which are represented by ellipses considered as latent construct (exogenous variables). These latent constructs are measured by nine questions (Q1-Q4 and K1-K5, represented in rectangle)) in the questionnaire. Consequently, these two constructs were deliberated as exogenous variables and the statistical SEM model recognized that they are inter-correlated.

Following the process described above, CFA was presented and the results show that the expectations for K5 parameter estimates were all significant and the intercorrelations among cost and knowledge is less than .85 and demonstrating a discriminant validity (.063). However results of the CFA indicated that GFI and CFI were not achieved required level and consequently respecifying the initial measurement model is inevitable (See table 5.9).

Table 5.7: External variables

Original Item	Item Label	Item Deleted
Cost		
I find that renewable energy products are more expensive	C1	
I find the purchase of renewable energy products a good investment for future	C2	
I find that renewable energy products are more expensive compared with other product brands.	C3	
I think that renewable energy products should be cheaper price to encourage their purchase.	C4	
Knowledge		
I think that the weather has become warmer in Malaysia	K1	
I think that the level of consciousness and knowledge amongst Malaysians regarding	K2	
Excessive burning of fossil fuel is the main reason for climate change.	K3	
The excessive use of natural resources (such as water and air) is the reason for climate change	K4	
Green technology minimizes degradation to the environment.	K5	Deleted

Reviewing the factor loading (regression weight) for each construct (table 5.8) indicated that K5 is below the acceptable level (.50) and should be deleted.

Table 5.8: Estimate factor loading for external variables

Label		Construct	Estimate factor loading
c1	<---	Cost	0.78
c2	<---	Cost	0.56
c3	<---	Cost	0.67
c4	<---	Cost	0.79
K1	<---	Knowledge	0.64
K2	<---	Knowledge	0.69
K3	<---	Knowledge	0.72
K4	<---	Knowledge	0.58
K5	<---	Knowledge	**0.44**

Table 5.9: Initial finding of fit indices for the measurement model 1

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.884	The required level is **not** achieved
RMSEA	RMSEA ≤ 0.08	0.0646	The required level is achieved
CFI	CFI ≥ 0. 9	0.898	The required level is **not** achieved
χ^2 /df	χ^2/df ≤ 0.5	3.451	The required level is achieved

After removing redundant items (K5) which had unacceptably low factor loading (0.44), the CFA was performed again.

Table 5.10: Final finding of fit indices for the measurement model of external variables

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.942	The required level is achieved
RMSEA	RMSEA ≤ 0.08	0.053	The required level is achieved
CFI	CFI ≥ 0. 9	0.942	The required level is achieved
χ^2 /df	χ^2/df ≤ 0.5	1.7	The required level is achieved

Modified model showed a fit to the data. Table 5.10 demonstrate final finding of fit indices. With regard to K5 this item was deleted because it has impact on dimensionality of the construct. Figure 5.13 demonstrates four indicators measuring knowledge and four indicators measuring cost were applied to examine the modified model.

As it is recommended for all of these measures the value of standardized factor loadings were all higher than 0.5. This condition proves the achievement of unidimensional scales for each of the factors. The new Measurement Model and factor loading for each construct is shown in figure 5.13.

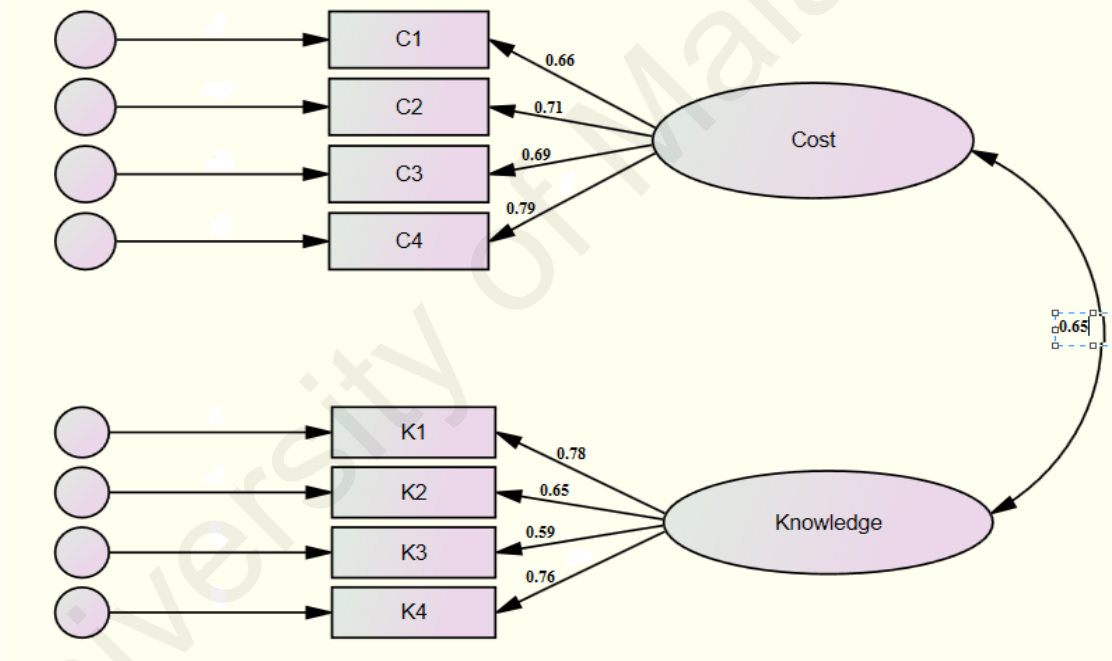

Figure 5.13: New measurement model

5.8.1.2. Perceived of usefulness (PU)

As presented in figure (5.14), 4 items (P1-PU4) were used to relate the PU to their measures in the questionnaire. The results of performing measurement model delivered evidence to accept the model. As table 5.11 shows all factor-loadings have obtained acceptable level (above .50)

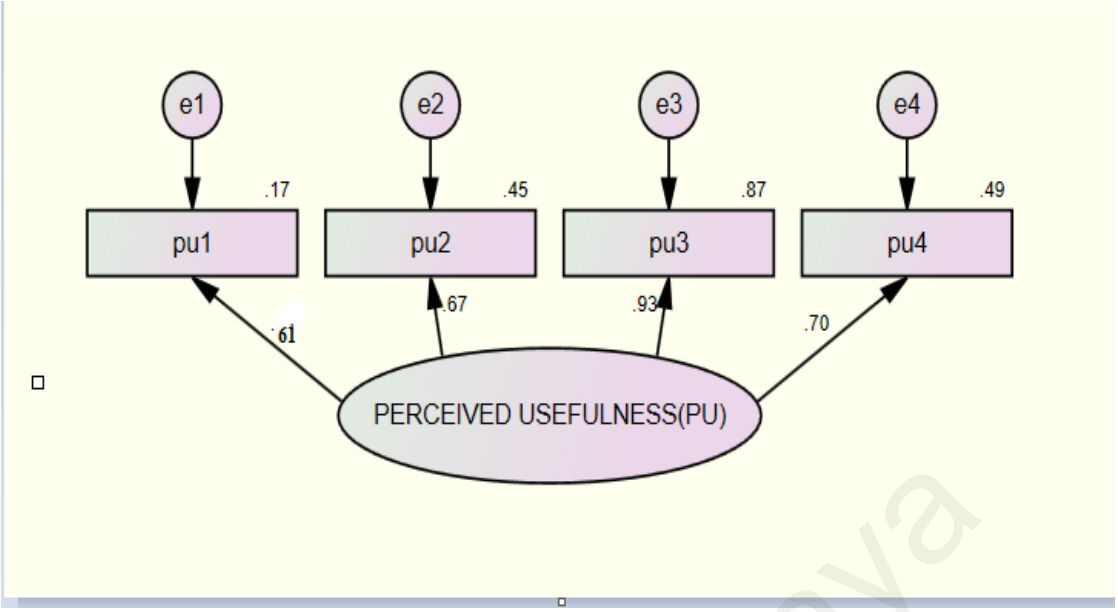

Figure 5.14: Measurement model for PU

Table 5.11: Estimate factor loading for measurement model of PU

			Estimate
pu1	<---	PERCEIVED USEFULNESS(PU)	.610
pu2	<---	PERCEIVED USEFULNESS(PU)	.671
pu3	<---	PERCEIVED USEFULNESS(PU)	.932
pu4	<---	PERCEIVED USEFULNESS(PU)	.703

Fitness Indexes for PU Measurement Modell (table 5.12) indicate that all of them achieved required value and as result suggest an adequate fit to the model.

Table 5.12: Final finding of fit indices for the measurement model of PU

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.992	The required level is achieved
RMSEA	RMSEA ≤ 0.08	0.083	The required level is achieved
CFI	CFI ≥ 0. 9	0.989	The required level is achieved
χ^2 /df	χ^2/df ≤ 0.5	2.84	The required level is achieved

5.8.1.3. Perceived ease of use (PEOU)

Four items were used to measure perceived ease of use variable (figure 5.15). The results of measured items of these variable are shown in table 5.13.

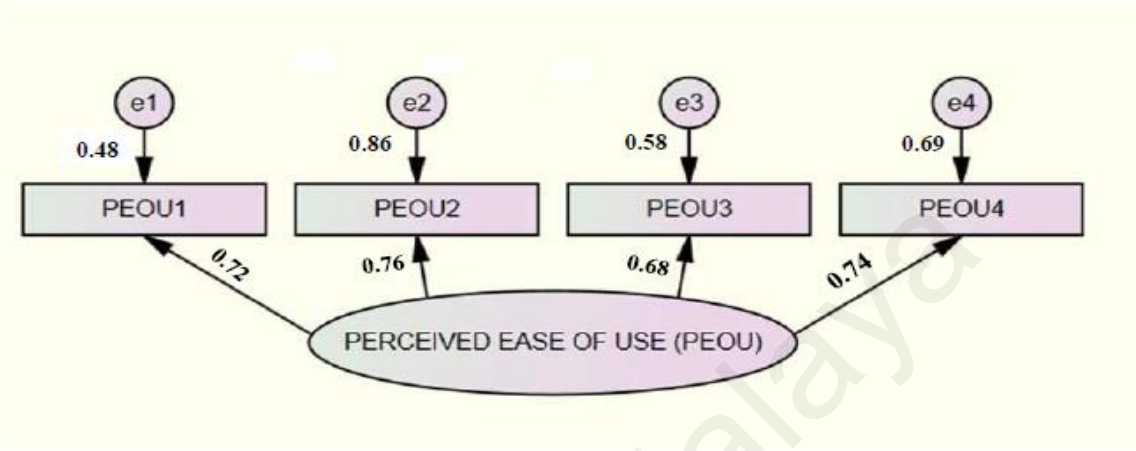

Figure 5.15: Measurement model of Perceived Ease of Use (PEOU)

Fit indices in table 5.14 demonstrate the statistical significance of all items and proves that this model satisfactorily fits to the data.

Table 5.13: Estimate factor loading for measurement model of PEOU

			Estimate
PEOU1	<---	PERCEIVED EASE OF USE (PEOU)	0.72
PEOU2	<---	PERCEIVED EASE OF USE (PEOU)	0.76
PEOU3	<---	PERCEIVED EASE OF USE (PEOU)	.680
PEOU4	<---	PERCEIVED EASE OF USE (PEOU)	.737

Table 5.14: Final finding of fit indices for the measurement model of PEOU

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.969	The required level is achieved
RMSEA	RMSEA ≤ 0.08	0.066	The required level is achieved
CFI	CFI ≥ 0. 9	.990	The required level is achieved
χ^2 /df	χ^2/df ≤ 0.5	1.9	The required level is achieved

5.8.1.4. Attitude toward Using Technology

The attitude toward using RE technology model (figure5.16) was measured using five indicators.

Table 5.15: Final finding of fit indices for the measurement model of Attitude toward using RE

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.969	The required level is achieved
RMSEA	RMSEA ≤ 0.08	0.066	The required level is achieved
CFI	CFI ≥ 0. 9	.990	The required level is achieved
χ^2 /df	χ^2/df ≤ 0.5	1.9	The required level is achieved

Table 5.15 presents that all of items are statically significant based on their parameter standardized estimates (P<0.001) and highly loaded on this factor (table5.16). It is found that measurement model of commitment sufficiently fits the data.

About the factor loading, table 5.15 reveals that all measuring items achieved acceptable factor loadings for the respective latent construct.

Table 5.16: Estimate factor loading for measurement model of attitudw toward using RE

			Estimate
AT1	<---	Attitude Toward Using Technology(AT)	0.61
AT2	<---	Attitude Toward Using Technology(AT)	0.69
AT3	<---	Attitude Toward Using Technology(AT)	0.79
AT4	<---	Attitude Toward Using Technology(AT)	0.71

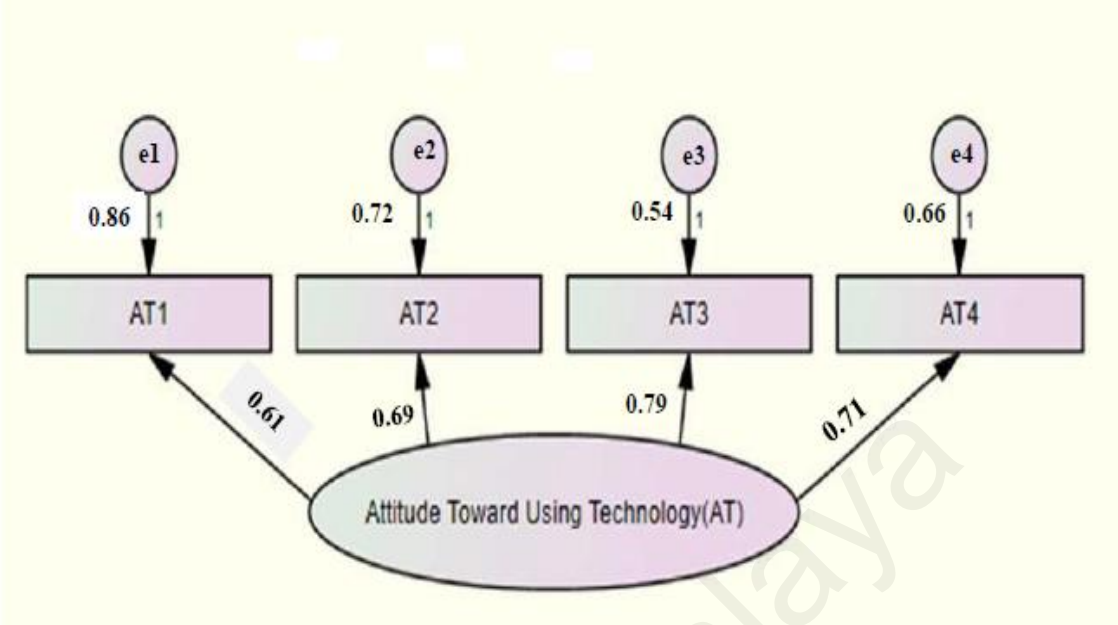

Figure 5.16: Measurement model of Attitude toward using technology

5.8.2. Assessment of Reliability and Validity of Constructs

For testing reliability, Cronbach's alpha, construct reliability (CR) and average variance extracted (AVE) were assessed. On the other hand, construct, convergent and discriminant were assessed to obtain validity (De Wulf et al., 2001)

5.8.2.1 Reliability of constructs

In this research study as mentioned in methodology section, reliability of the measures was examined by assessing Cronbach's (1951) coefficient alpha, Construct reliability (CR), and Average Variance Extracted (AVE).

Regarding Cronbach's coefficient alpha, Table 5.9 shows that all the constructs exceed the suggested level of .70 (Nunnally, 1978). CR and AVE were calculated from model estimates using the CR (formula 5) and AVE (formula 6) given by Fornell and Larcker (1981).

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$$

In the formula mentioned above λ represents factor loadings (standardized regression weights) and i represents total number of items, and δ represents the error variance term for each latent construct.

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

In the formula mentioned above **λ** represents factor loadings (standardized regression weights) and ***i*** represents the total number of items.

The proposed values for CR and AVE are 0.6 or greater and 0.5 or greater respectively. (Bagozzi and Yi, 1988). Based on these assessments, measures used within this thesis were within the acceptable levels supporting the reliability of the constructs (see Table 5.17).

Overall, these results of Cronbach's coefficient alpha, AVE and CR indicate that requirement value for obtaining reliability is achieved.

5.8.2.2. Validity

As discussed earlier, a confirmatory factor analysis (CFA) was conducted to assess the reliability and validity of the measures. Construct validity is achieved when the fitness Indexes for a construct reached the required level. Table 5.17 shows results of the measurement model and according to goodness-of-fit indices it is proved that the construct validity was acquired. (Hsieh et al., 2005).

Table 5.17: Measurement Model Evaluation

Construct	Items	Standardized Loading	Cronbach's alpha (α)	CR ≥0.6	AVE ≥0.50
PU			.734	.81	.7
	PU1	.73			
	PU2	.80			
	PU3	.73			
	PU4	.78			
PEOU			.74	.77	.73
	PEOU1	.72			
	PEOU2	.78			
	PEOU3	.75			
	PEOU4	.75			
Cost			.79	.77	.84
	C1	.79			
	C2	.77			
	C3	.78			
	C4	.72			
Knowledge			.90	.76	.55
	K1	.71			
	K2	.78			
	K3	.79			
	K4	.74			
Attitude toward using RE			.87	.77	.65
	AT1	.69			
	AT2	.78			
	AT3	.75			
	AT4	.94			

As for convergent validity, confirmatory factor analysis and average variance extracted (AVE), has also been used to assess this validity. By way of demonstrating in table 5.9 all factor involved high loadings (above 0.5) and were statistically significant. The results of AVE performed in table 5.13 present a further support for convergence validity.

"Discriminant validity is assessed to be adequate when the variance shared between a construct and any other construct in the model is less than the variance that the construct shares with its indicators" (Teo, & Noyes, 2011, p.1649). As recommended by Thompson (1997), in this study, discriminant validity was assessed by comparing the square root of

the AVE for a given construct with the correlations between that construct and all other constructs. If the square roots of the AVEs are greater than the off-diagonal elements in the corresponding rows and columns and exceed the correlations between a given construct and others in the model, discriminant validity is achieved. Appendix C shows the diagonal elements in the correlation matrix to be greater than the off-diagonal elements, indicating that discriminant validity to be satisfactory at the construct level in this study.

5.8.3. Review of Measurement Model (Stage One)

As explained earlier, measurement model for each construct was assessed in two step. By conducting CFA first relationships between the factors and their items (Unidimensionality) was assessed, than reliability and validity was tested. Results showed that acceptable fit index is achieved for each construct.

Table 5.17 demonstrated that the value of Cronbach's alpha, CR and AVE are in line with proposed levels required for this research study (i.e., .70 for Cronbach's alpha, .60 for CR, and .50 for AVE. Hence, levels for the reliability of variables are satisfactory. Regarding validity, since all items were statistically significant convergent validity was supported. Moreover, convergent validity was also supported by being AVE .50 and over. In addition, construct validity and discriminant validity were achieved because of fitting of the model and comparing the square root of the AVE for a given construct with the correlations.

5.9. Stage Two: Structural Model (Testing of the Hypotheses)

In the current study, structural model aims to test the underlying hypotheses as presented in Table 5.18.

Table 5.18: Underlying hypotheses

H1: Cost → PU	Cost will have effect on PU
H2: Cost → PEOU	Cost will have effect on PEOU
H3: Knowledge → PU	Knowledge will have effect on PU
H4: Knowledge → PEOU	Knowledge will have effect on PEOU
H5: PEOU → Attitude	Perceived ease of use(PEOU) will have effect on attitude toward using technology
H6: PEOU → PU	Perceived ease of use (PEOU) will have effect on users' perceived usefulness (PU) of an Attitude toward using RE.
H7: PU → Attitude	Perceived usefulness(PU) will have effect on perceived ease of use(PEOU)

These hypotheses are represented in seven paths (H1, H2, H3, H4, H5, H6 and H7) to determine the relationships between the constructs in the adopted model. As the second and main step of the analysis, structural model should be tested when all constructs in the measurement model (stage one) were validated and satisfactory fit is achieved (Anderson and Gerbing, 1988). As noted by Tabachnick and Fidell (2001), for evaluating the structural model, goodness-of-fit indices are examined as well.

5.9.1. Structural Model One (The Hypothesized Model)

In this stage, first, the full SEM model including all indicators was tested. (See figure 5.17). The fit indices of initial SEM test for the proposed model are presented in table 5.18. Since the assumptions underlying SEM were met (unidimensionality, validity and reliability for each construct), the analyses of the hypothesized structural model were conducted by examining coefficient parameter estimates as well as the overall model fit indices. In table 5.19, four indices include the goodness-of-fit index (GFI), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the normalized chi-square ($\chi 2/df$) show this model adequately fits the data. All these fit indices suggest that the covariance structure constructed in the substantive model fits the data acceptably.

Table 5.19: Fit indices for the structure model

Name of index	Level of acceptance	Index value	Comment
GFI	GFI ≥ 0.90	0.904	The required level is achieved
RMSEA	RMSEA ≤ 0.08	0.0646	The required level is achieved
CFI	CFI ≥ 0. 9	0.902	The required level is achieved
χ^2 /df	χ^2/df ≤ 0.5	3.451	The required level is achieved

After fit indices for the substantive model was achieved, hypothesis was tested. In testing the hypothesized model, results presented in table 5.20, indicate that the **hypotheses H1, H2, H3, H5, H7** were statistically significant and in the hypothesized direction.

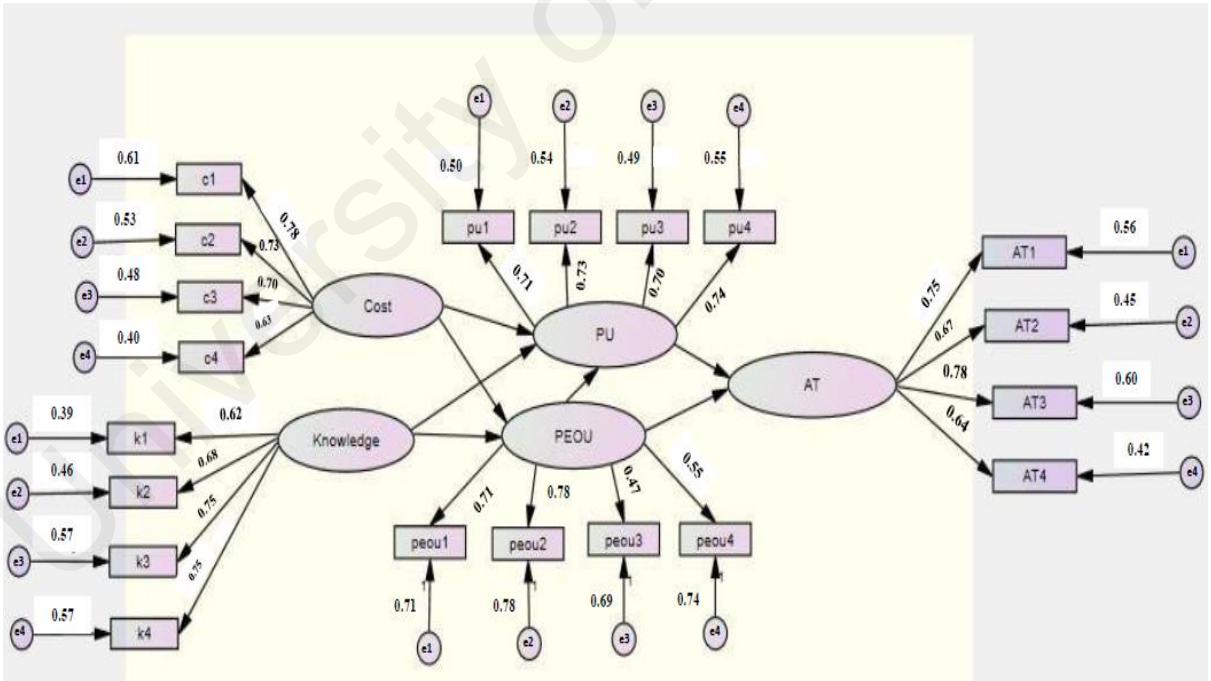

Figure 5.17: Structural Model One

For these hypotheses all of the standardized estimates were significant (p =.001, .001, .012, .006, and .001). Consequently, these hypotheses were supported.

On the contrast hypotheses H4 and H6 were refused because both of them were statistically insignificant. (p =.629 and 0.546 respectively). The indices for goodness-of-fit demonstrate that this model fits the data adequately, even though chi-square was significant (x2 = 197.53).

The model, however, reveals that two of seven paths (H4 and H7) were not statistically significant (P>0.05).

Table 5.20: Results of testing the hypothesized model

Hypothesis	Construct	Path	Construct	P-Value	Result	Result on Hypothesis
H1	Perceived usefulness (PU)	←	Cost	0.001	Significant	Supported
H2	Perceived ease of use (PEOU)	←	Cost	0.001	Significant	Supported
H3	Perceived usefulness (PU)	←	Knowledge	0.012	Significant	Supported
H4	Perceived ease of use (PEOU)	←	Knowledge	0.629	Insignificant	Not Supported
H5	Attitude	←	Perceived ease of use	0.006	Significant	Supported
H6	Perceived usefulness	←	Perceived ease of use	0.546	Insignificant	Not Supported
H7	(PU)Attitude	←	Perceived usefulness	0.001	significant	Supported

These results indicates that the path connecting knowledge with PEOU (H4) and the path connecting PEOU with PU (H6) were the paths to be deleted. Thus, eradicating nonsignificant paths so called re-specification of the model would probably cause a better fit to the data.

5.9.2. Structure model two

If the results achieved from testing the original structure model are collated to the theoretical basis of the model, it will be obvious that two paths needed to be eliminated. But it should be noted that as proposed by Holmes-Smith et al. (2006) the process of eliminating must be conducted by omitting just one non-significant hypothetical at a time. The reason of this approach is that removing one path at a time could change the

modification indices, structural coefficients, and their significance. Therefore, the non-significant path between knowledge and perceive of usefulness and perceived ease of use and perceive of usefulness were deleted, as it is the lowest standardized estimate value. (See figure 5.18).

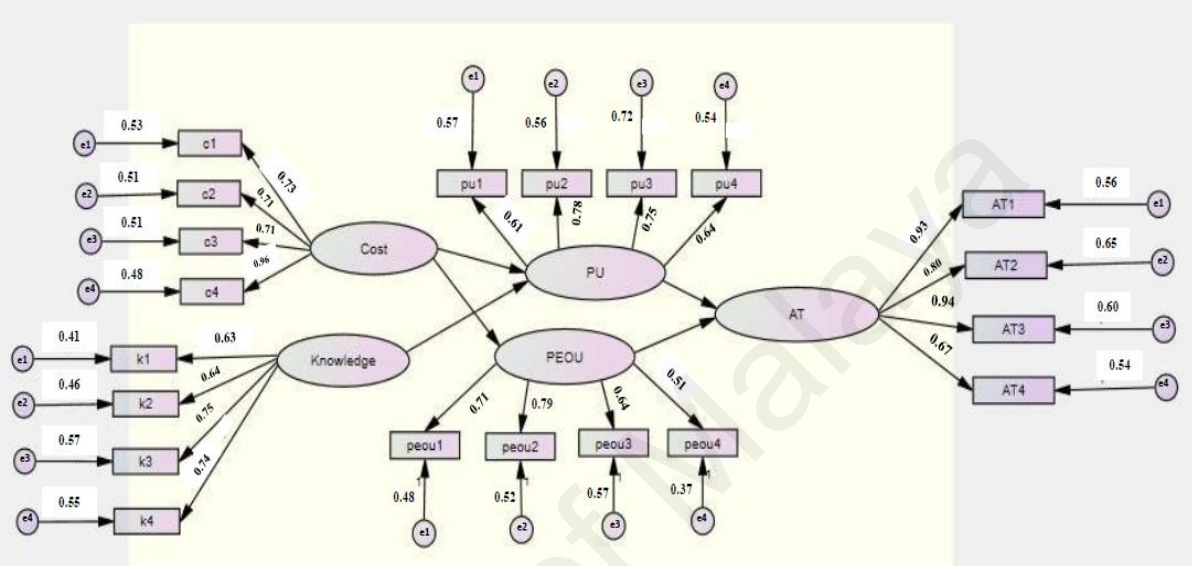

Figure 5.18: Structure model two

Following this, the model was reanalyzed. The results indicate that the hypotheses H1, H2, H3, H5 and H6 were accepted, because they were statistically significant (P = .012, .012, .001, .001, .014) (see table 5.21).

Table 5.21: Results of testing the hypothesized model (structure model two)

Construct	Path	Construct	P-Value	Result	Result on Hypothesis
H1 :Perceived usefulness	←	Cost (H1)	0.012	Significant	Supported
H2 :Perceived ease of use	←	Cost (H2)	0.012	Significant	Supported
H3 :Perceived usefulness	←	Knowledge (H3)	0.001	Significant	Supported
H5 : Attitude	←	Perceived ease of use (H5)	0.001	Significant	Supported
H6 : Attitude	←	Perceived usefulness (H7)	0.014	Significant	Supported

The goodness-of-fit indices prove the adequate fitting between the modified model and data. Comparing the original structural model to structural model two based on attained results confirmed that structural model two is a better fit of the data. To summarize, it is both theoretically and empirically proved that the best parsimonious model was accomplished after two path performing H4 and H6 had been removed. Thus structural model two approved as the ultimate model.

5.9.3. Review of structure model (stage two)

The second stage of the structural model showed that except for H4 and H6, the remaining five hypotheses were significant and were supported. This indicated that further re-specification for the model was required. Therefore, the original model was modified by removing one non-significant path. Further details about the hypotheses of this thesis are discussed in the following section

5. 10 Results of Hypotheses testing

Overall, seven hypothesis is tested. The results of testing hypothesis are presented in below.

5.10.1 External variables

As presented before, the relation between the external constructs (cost and knowledge) and endogenous constructs (PU and PEOU) are defined by four hypotheses H1, H2, H3, and H4. As outlined in Table 5.20, three of these four hypothesized relationships (H1, H2) and H13) were found to be significant. Therefore, these were supported. On the contrast the relation between knowledge and PEOU performed by hypotheses H4 was not supported because the P value was non-significant.

5.10.2 PU and Attitude toward using RE technology

Hypothesis five (H7) is the relationship between PU and AT. Both of these variables

were considered as endogenous. Results affirmed a significant path and by this means H7 was supported.

5.10.3 PEOU and Attitude toward using RE technology

Hypothesis H5 represents the relationship between the two endogenous variables, PEOU and AT. Based on the results revealed in this chapter, it has been acknowledged that this hypothesis was statistically significant, and thus accepted.

5.10.3 PEOU and PU

Another hypothesis which is tested in this thesis was the impact of PEOU on AT through PU. The result of parameter estimate indicates that this hypothesis (H6) was statistically not significant and therefore this hypothesis was refused.

5.11 Qualitative Analysis

As it is mentioned in chapter four in this thesis the analyses are based on quantitative and qualitative data. The qualitative approach allows the researchers to attain deep knowledge about a given phenomenon and to develop a highly descriptive comprehension of the subject under study.The qualitative analyses disclose the factors that affect user acceptance of renewable energy technology in Peninsular Malaysia.

The qualitative analysis draws on semi structure interviews conducted in 2014 with a selected subsample of 35 energy experts who are living in kuala lumpur. These energy experts are including 18 academic staff members and 17 members of Energy Companies.

The qualitative analyses reveal the impact of cost and knowledge (external variables) on PEOU and PU. To better understand the role that cost and knowledge play in renewable energy acceptance in peninsular Malaysia the TAM was used in qualitative part as conceptual framework as well.

Due to its holistic approach, the TAM framework allows researchers to comprehend coast and knowledge barriers facing renewable energy development; thus, it is used here to examine the renewable energy policy in Peninsular Malaysia.

In this section provides researcher provides details about the cost and knowledge barriers to develop renewable energy policy in Peninsular from the TAM perspective.

5.11.1 Impact of knowledge

Some respondents reported knowledge as a barrier that prevents RE policy in Malaysia from being successful. Some the interviewee' respond are presented in table

Table 5.22: Interviewee' respond about impact of knowledge

Number of interviewee	Comments
Interviewee 1	"*Between 2005 and 2007, I was involved in a solar project and performed some site visits. I remember that one main and common complaint of stockholders and developers was the lack of skilled technicians, installers, and maintenance personnel.*"
Interviewee 2	"*Absence of trained staff to install and maintain renewable energy equipment was one of the main reasons for failing RE projects. A good example of this failure was the SREP program, which during the 8th Malaysian plan, only achieved 4% of the target.*"
Interviewee 3	*"In terms of knowledge and understanding about renewable energy issues, there was a tension between the federal government on one hand and the state and local governments on the other hand. "*
Interviewee 4	*"National agencies may provide renewable energy policy goals, strategies, funding, and assistance, but the majority of the required day-to-day relationships and actions to apply policies to the target people must come from the state and local level. However, there was no communication of knowledge among these government stages, and thus, the renewable energy polices failed during their implementation."*

Number of interviewee	Comments
Interviewee 6	*"In Malaysia many people believed it is their birth right to consume as much of fossil fuel as possible at a low price."*
Interviewee 7	*"People p`refer to act on the secure basis, thus, they need to accept that applying RE make their lives better."*
Interviewee 8	*"Multi-cultural factor can either be a social barrier or a driver of their implementation. Unfortunately, during the 8th and 9th developing plan, this factor had no place in the plan and implementation of RE policy."*
Interviewee 9	*"Malaysian government placed priority on one policy in theory, and another in practice."*
Interviewee 10	*"After announcing the five fuel policy and setting the 5% target for Renewable energy, it was predicated that the government budget appropriations for environmental R&D would increase, but we faced the opposite situation. In 2002, total R&D expenditure in Malaysia was 0.69% of the GDP, while in 2006, this figure declined to 0.64% of the GDP."*
Interviewee 11	*"The Malaysian government had no comprehensive policy for encouraging the private sector to expand environmental industry and attract environmental investment, especially in the renewable energy area."*
Interviewee 12	*"I do believe setting the 5% target for RE was not defendable, because at that time, the Malaysian situation in terms of infrastructure, public opinion, government fiscal policy, local banks, and the availability of related technology were not ready for this target."*

5.11.2 Impact of cost

Most interviewees agreed that economic barriers to the advancement of RETs existed in Malaysia and led to the failure of RE policies. Some of the respondent's respond about the impact of cost are presented in the table 5.23.

Table 5.23: Interviewee' respond about impact of cost

Number of interviewee	Comments
Interviewee 1	*"Malaysia is among the nations with the highest subsidies. When the 8th Malaysian plan announced the government's intention to move toward renewable energy, it was hoped that fuel subsidies would be gradually cut in favour of renewable and clean energy; however, the share of fuel subsidies in the total government subsides increased significantly."*
Interviewee 2	*"The fuel subsidy was indiscriminately applied in Malaysia and impacted all fuel consumers. For example, the average retail fuel price in Malaysia was very low compared to other countries."*
Interviewee 3	*"Because of inadequate tariffs, renewable energy producers could not sell their power to the market at a profitable price."*
Interviewee 4	*"In 1990, the electricity tariff policy in Germany allowed the renewable energy developers to sell their power to utilities at 90% of the retail market price, while in 2007 in Malaysia, in the best case, a renewable energy developer could sell their power between 15% to 20% of the market price."*
Interviewee 5	*"In Malaysia, the cost of producing energy from renewable energy, for example, biomass or solar thermal, was at least four-fold that of traditional energy, so it was no surprise that investment in renewable energy was not attractive."*

Number of interviewee	Comments
Interviewee 6	*"During the 8th and 9th Malaysian plans, because of the lack of local manufactures, the prices of PV systems were extremely high. As a result, the PV business became unsustainable and a flat income stream."*
Interviewee 7	*"Because of some RE's inherent barriers, some programs such as hydropower failed to meet their targets. This failure is because in Malaysia, between dry and wet seasons, a great difference in delivering water can be seen."*
Interviewee 8	*"When Malaysia decided to move toward renewable energy in 2000, RE technology in Malaysia was in its infancy, and further development largely depended on massive transfers of relevant technologies from developed countries, which has yet to occur."*
Interviewee 9	*"The Malaysian prime minister in 2009 clearly asserted that Malaysia needed access to a massive transfer of technology, including RETs for addressing climate change, which meant that during the years before 2009, the absence of green technology for renewable energy in particular was evident in Malaysia."*
Interviewee 10	*"In some RE projects, such as solar projects, the absence of technical standards led to the installation of poor-quality technology."*

5.12 Conclusion

Overall, this chapter explained that screen the data to deal with missing values and normality, various statistical procedures were implemented. A summary of the main findings and fit of each measurement model and results of testing reliability and validity also reviewed. The chapter then moves on to explain the results of hypothesized structural model. The next chapter discusses the above results and finding of qualitative part of this study in detail in order to answer the four research objectives outlined in Chapter 1.

CHAPTER 6: DISCUSSION

6.1 Introduction

Discussions are provided in this chapter. This chapter is divided into four main sections, each of which presents the results relating to one of the research objectives. The main objectives of this study is presented in section (6.1). It goes on to discuss about the level of public awareness of global climate change and RE technology which is address first research objective. The next section (6.3) discusses the influence of PU and PEOU on attitude toward using RE technology which is address second research objective. Section 6.4 discusses the influence of PU and PEOU on attitude toward using RE technology which is address third research objective. Then section 6.5 and 6.6 discusses impact of knowledge and cost on attitude toward using RE technology.

In the last section conclusions drawn based on discussion of the research findings is presented. Main findings of the qualitative study which have arisen in interview with academic staff and experts in the field of RE are provided in each section.

6.2 Overview of This Research

This study combined and built upon factors from various well-known theories and models by extending the model of technology acceptance within the context of RE technology.

Having this background, the main objectives of this research include identifying factors that influence citizen' attitude to accept Re technology, determining the level of public awareness of global climate change and the use of RE technology in peninsular Malaysia, developing a model of factors that positively influence users' attitude towards acceptance of RE technology, and testing and validating the hypothesised model by exploring relationships between the studied factors.

The process of this research, includes both qualitative and quantitative approaches

while mainly using a field survey for collecting primary data. The applied approach in SEM was a two-stage approach. Validity and reliability of the constructs within the model were evaluated. To do so, the measurement model was tested by adopting the CFA method. In the second stage, a hypothesised structural model was examined using the path analysis technique in order to test the causal relationships among the proposed constructs in the research model.

Next, the structural model was tested and finally, a discussion of the outcomes of this research is presented in the results section. All in all, the fundamentals of discussion in this chapter is research objectives, hypotheses testing results and findings in respect to the proposed hypothesised research model.

6.3 Level of public awareness of global climate change and the use of RE in Malaysia

A number of authors such as Patchen (2006), Moser (2006) and Kollmuss and Agyeman (2002) has emphasized the importance of people's awareness as the core element to improve environments for better quality of life and addressing climate change issue. However, few writers have been conducted such study in the context of Malaysia. In this thesis, the first objective aimed to determine the level of public awareness on the issue of global climate change and the use of renewable energy technology in Peninsular Malaysia.

With respect to this objective, it was found that majority of citizen in peninsular Malaysia (69.75%) are concerned about climate change. What is interesting in this data is that, Similarly, Corner, at all (2011) report that 71% of UK population were either fairly or very concerned about climate change.

Another important finding was that in peninsular Malaysia the term “climate change” evokes different free associations among the public, however, the term climate change elicits significantly more associations to weather. It is worth mentioning that the study by

Leiserowitz, A. (2006**)** stressed that asking a question such as "When you think of global, what is following statements comes to your mind?" is a powerful technique that generates a rich dataset of free associations that are then categorized into common themes. Similarly this technique was used in this study and the abovementioned outcome was created. Interestingly, in the same vein, Leiserowitz, et al (2014) reported that for American public, climate change also provokes significantly more associations to Weather.

Regarding the first question the results of this study also show that majority (81%)of respondents believe that the main reason for climate change is a human activity; while 19% think that natural processes alone is the cause of climate change.

A seminal work in this area is the work of Leiserowitz, et all (2015) which reports that Currently, about half of Americans (53%) think that climate change, if it is happening, is mostly human caused. Contrary to expectations, this study did find a significant difference between citizens in the United States and peninsular Malaysia about their opinions regarding the causes of climate change.

A possible explanation for this might be that the public in peninsular Malaysia tend to believe that much of the burden for dealing with climate change should be shouldered by wealthier countries. This interpretation further support the outcomes of Pew research centre report (2015) which indicate that the public believe that "Rich countries, such as the U.S., Japan and Germany have produced most of the world's greenhouse gas emissions so far." So they should do more than developing countries.

This result may be also explained by the fact that from the total CO2 emissions from fuel combustion in Malaysia which it was 164.2 Mtc (million tonnes) in 2013, the transport sector which can reflect the role of human activity in Co2 emissions is responsible for a quarter of them by 41.2 Mtc Co2 emissions. According to the Malaysia

Environmental Quality Report, 95% CO, 29% NO2, 17% PM (Particulate Matter), 8% SO2, and significant quantities of hydrocarbons (VOC), were emitted by the transport sector and passenger cars are the major contributors of CO2, N2O, and CO pollution emissions (Ong HC et al, 2011).

With respect to awareness about RE technologies and products, it was found that nearly three-quarters of the respondents have heard about renewable energy products. However, only 42.5% of the respondents have ever used renewable energy products. Interestingly the majority of respondents (six out of ten) also believe renewable energy products have a positive impact on the environment and majority of the public also (seven out of ten) believe developing RE is a 'good idea'.

It can thus be suggested that the public in peninsular Malaysia displays a solid awareness about climate change and support for environmental goals such as RE policies at the general level. They also demonstrates a general awareness and concern for global climate change.

These findings clearly show that the respondents are aware of renewable energy products on the market and its positive impact, but often, they do not use them in practice.

This finding is also consistent with studies conducted by Mohamad Sabri and Teoh (2006). They found that caring for the environment is higher than the practice green consumerism among consumers in Petaling Jaya.

A possible explanation for this might be related to the cost of RE products which according to the findings of current study, majority (81%) of the respondents think that the price of RE products are more expensive. More details about the impact of cost will be discussed in section (6.6). Another possible explanation for this is that most of the respondents had never heard of or know about the policies that have been implemented

by the government of Malaysia over the past few years to support the country's climate and Renewable technology policies. Data analysis clearly showed that the majority of government's policies and programs still are not realized or known.

It is worth mentioning that since climate change has developed as a growing concern in the world, the role of government has gained increasing attention at both national and sub-national levels. In particular, within federal systems, sub-national governments have played a larger role in addressing climate issue and applying energy related policies (Borick et all, 2010)

The results of this study show that the public believes the government's efforts have not succeeded and the findings are consistent with a low level of knowledge about the existence of policies and programs. Moreover, this analysis, clearly shows that in the view of the majority of the public, government policies and programs fail.

Moreover, some of the respondents in the qualitative study revealed that developing renewable energy in Malaysia requires a fundamental system change, but government has failed to play its role in making this necessary change.

For example, one participant indicated that the "Malaysian government gave priority to renewable energy only in plans, and not in practice." Another interviewee mentioned that the "Malaysian government placed priority on one policy in theory, and another in practice."

As a sign of the low priority for Malaysian government to develop RETs, one respondent highlighted the small environmental R&D budget and noted that "In 2002, total R&D expenditure in Malaysia was 0.69% of the GDP, while in 2006, this figure declined to 0.64% of the GDP."

It is worthwhile to note that in the energy sector, government R&D programmes and R&D pursued by government play a vital role in generating knowledge. Thus, the lack of funding for new knowledge creation in renewable energy technologies possibly allowed detrimental business-as-usual scenarios to persist. Another interviewee explained that "the Malaysian government had no comprehensive policy for encouraging the private sector to expand environmental industry and attract environmental investment, especially in the renewable energy area."

Poor communication and lack of harmony among different institutions and departments involved in planning and implementing renewable energy is also mentioned as a sign of failure of government in developing RE policies by some of the interviewees. One academician commented that "in the period of 2000 to 2010, at least 7 major ministries and departments were involved in renewable energy planning, including the Ministry of Energy, the Malaysian Energy Commission, Tenaga Nasional Berhad (TNB) and the Main Malaysian energy provider, the Ministry of Housing, the Ministry of Science, and the Department of Environment. There is no doubt that creating harmony and agreement among these players was very challenging."

Another interviewee stressed that "in my opinion, if instead of different department actors in the renewable energy area, a single government organisation took responsibility for the development of renewable energy, then the outcome of a renewable energy plan in Malaysia would have been more successful." The different parties involved in renewable energy policies and implementation make it difficult to reach agreement about the existence and significance of specific problems. Note that "When responsibility for renewable energy policies and planning is divided among the departments, this can result in poor communication and thus a lack of commitment to push forward the renewable energy policy". As far as public awareness in the state level is concerned, it is important

to note that data analysis demonstrates that awareness of public in the central region are considerably higher than the average of peninsular Malaysia, while in contrast in the southern region, respondents' awareness is considerably less than the other regions and average. It seems possible that these results are due to regional disparities or imbalance which refer to a "situation where per capita income, standard of living, consumption situation, industrial and agriculture and infrastructure development are not uniform in different parts of a given region" (Krimi et all , 2010) .

Table 6.1 demonstrates GDP Per Capita by State in Peninsular Malaysia which indicates that Kedah in south region has less GDP in comparison to central (Kuala lumpur) which has the most. Another explanation might be related to the fact that RE in Malaysia is focused mainly in the big and modern cities rather than small states like Kedah. So, renewable energy in the south region is still a new phenomenon. Furthermore, SEDA (Sustainable Energy Development Authority) didn't focus on educating the local community in the southern region regarding renewable energy, whereas the renewable-energy project already existed in Kedah. (Zulkifli et all, 2015)

Table 6.1: GDP Per Capita by state – 2012 -2013 at current price – RM

State	2012	2013
Kuala lumpur	35.916	37.851
Johor	24.569	25.302
Terengganu	22.717	23.285
Kedah	15.777	16.316

One of the issues that emerge from these findings is that government has to allocate specific regional policy for each state. It is essential to recognise the local conditions in developing countries and encounter the vital energy service demands with suitable technologies.

To enhance the role of government and formulating RE policy in a more effective way in Malaysia, it is compulsory for RE to become the agenda for all levels of government in this country.

According to Anderson (2014), of the thousands and thousands of demands made upon government, only small number will receive serious consideration at any time and public demands the government's action upon it. This is evident in the case of case of environmental pollution control in USA.

Although environmental pollution has long been a condition in America, only in 1960, did pollution begin to be widely perceived a major public problem. Several factor have contributed to making pollution control an important item on America's policy agenda. For instance Rachel Carson's *Silent Spring* called attention to detrimental effects of the extensive application of chemical pesticides and raised public awareness about the adverse consequences of pollution (Anderson, 2014)

6.4 PU, PEOU and Attitude toward using RE

The second objective is to evaluate the impact of perceived usefulness (PU) and perceived ease of use (PEOU) on the renewable energy acceptance in Peninsular Malaysia.This is the first study to explore the effects of PU and PEOU on attitudes toward using renewable energy technology in the Malaysian context. A model based on the technology acceptance framework was tested. Structural Equation Modelling (SEM) was used for the model estimation. Structural equation modelling provides the opportunity to estimate the unique effect of each variable, taking into account that the determinants also influence each other and some variables have a direct effect, while other variables have an indirect effect.

The results of this study show that both PU and PEOU are important in determining the acceptance and use of renewable energy in Malaysia. In the proposed model, it is

hypothesized that PU will have a positive effect on the attitude toward using RE (H1). The estimate results for the above hypothesis was found both positive and statistically significant therefore it can be accepted that PU has a positive effect on the usage of RE. This hypothesis was drawn from the original TAM.

Moreover, this research acknowledged the power of user's positive thoughts and beliefs about the effectiveness of RE technology. The results of this study are found to be consistent with previous studies and the TAM findings.

For example Liang and Yi-Hsuan (2009), claimed that PU has been proven to be the most significant element in explaining why people adopt a technology and because of that, this concept "has remained relatively unchanged since the inception of the research stream." Venkatesh et al. (2003) also mentioned that PU is a powerful element for "intention to use" in technology adoption. Similarly, Han (2003) pointed out that in determining usage attitude toward using RE technology, the importance of PU should be stressed. PU has been consistently shown to be an influential predictor for "intention to use" in technology adoptions and related literature (Venkatesh et al., 2003).

The suggested model in this thesis also proposes hypothesises the existence of a direct positive relation between perceived ease of use (PEOU) and the attitude toward using RE technology (AT). In other words, the higher PEOU the more used RE technology. The vital effects of PEOU on tendency to the acceptance of new information system is postulated by TAM. (Davis et al., 1989; Mathieson, 1991).

In coordination with the practical results of former research, the significant effect of the POEU on approach to using technology is established.This study therefore provides empirical evidence to support the earlier findings that PEOU was a significant predictor of the intention to use the Re technology. On the other hand, PEOU and PU have impressive impacts on the users' motivation to consume the RE technology.

In this thesis, it is hypothesis that PEOU will have an effect on PU (H7). One of the unexpected results of this research was the relation between perceived ease of use and citizens' opinions about the usefulness towards the acceptance of RE technology. Based on the findings of this study, the former has no effects on the later. This outcome was surprising because the H7 was drawn from TAM model as Davis (Davis et al., 1989) and some other researchers in the field of the technology acceptance did the same (Adam et al., 1992; Lee at al., 2001)

This inconsistency may be due to nature of RE technology. Renewable energy is often generated on a distribution network near the final consumers. Consumers may only pay wholesale prices for the generated power. This may lead to the fact that locational value of the power is not captured by producers

The RE technology may require users' complete confidence in the privacy and confidentiality of online security. Therefore, it can reasonably be concluded that a user's assessment of the usefulness of an OBIS cannot be influenced solely by the ease of use of these systems. Nevertheless, Chandio (2011) andHu et 207 al. (1999) also found no significant relationship between PEOU and PU.

6.5 Knowledge, PU, PEOU and Attitude toward using RE

Correlations between knowledge of a technology and acceptance of the technology have been studied more widely (Achterberg et al., 2010; O'Garra and Mourato, 2008, Duan, 2010). It is apparent from previous research that people will support using RE technologies if they do not require a significant alteration of lifestyle, understand the scientific basis for such programs, consider the issue to be a very serious societal or ecological problem, or one that affects them personally (O'Connor et al, 1998;; Lorenzoni & Pidgeon, 2006; Sterman & Sweeney, 2007).Although extensive research has been carried out on this area in other context, few study exists in Malaysian context.

In this study the third objective was "evaluating the impact of cost and knowledge on the renewable energy acceptance."

In agreement with those obtained by Huijts et all (2012) and Molin (2005) current research can acknowledge that knowledge can play an important role in acceptance of RE technology. This result also seems to be consistent with other research which concluded that knowledge of hydrogen vehicles positively affects attitude towards the air and noise pollution reduction associated with the introduction of hydrogen buses in London (O'Garra and Mourato, 2007).

This result can easily lead to the idea that more knowledge automatically leads to higher acceptance and that knowledge can be increased by providing information. However, regarding the impact of knowledge on acceptance, it is important to note that it is wrong to make the assumption that increasing knowledge automatically increases acceptance.

The positive relationship between knowledge and acceptance could be explained by the fact that the people who already intended to use RE products informed themselves more thoroughly. Moreover, the people who had a technical education, tend to have more knowledge and also a more positive attitude towards technology in general. Correlations between knowledge and acceptance were also found in two studies (DTI, Scottish Executive et al., 2003).

It is important to note that in contrast to our finding, Ellis et al. (2007, p.520) reported that in other fields of technology acceptance, for example windmill acceptance, the findings did not indicate that people with a low acceptance have less knowledge: on the contrary, "objectors actually appeared to be extremely well informed" which means that This findings cannot be extrapolated to other technologies.

Importance of Knowledge for accepting RE technologies was echoed by majority of the interviewees in the qualitative part of study as well. Some respondents reported lack of knowledge as a barrier that prevents RE policy in Malaysia from being successful. Those who agreed about the existence of knowledge barriers listed some items as major factors. For example they mentioned that lack of knowledge could negatively affect social acceptance for renewable energy in Malaysia.

Note that although social acceptance as a part of renewable energy technology implementation has largely been neglected in the eighties, recently, it has been increasingly recognised as a potential barrier to the achievement of renewable energy targets. In this aspect, one respondent stated that "in Malaysia many people believed it is their birth right to consume as much of fossil fuel as possible at a low price". Another interviewee explained that "people prefer to act on the secure basis, thus, they need to accept that applying RE makes their lives better.

The results of this study also acknowledge that knowledge regarding renewable energy has an impact on the attitude toward using RE only through its indirect impact on PU. The results for this factor indicate that the hypothesis that claims that knowledge positively affects PEOU should be rejected, and only the positive impact of knowledge on PU is supported.

This result implies that knowledge regarding renewable energy does not coincide with the perception that using renewable energy would be effortless. Therefore, people feel that the use of renewable energy would involve a high level of effort, and this has a negative effect on their attitude toward using renewable energy technology. There are several possible explanations for this result.

First, a possible explanation for these results may be a lack of knowledge and skill among the professionals and technicians in the renewable energy sector. Ölz and Beerepoot (2010) have emphasized that limited capacity in renewable energy technology manufacturing and service, and a lack of skilled technicians for the installation and maintenance of technologies impede the introduction of renewable energy technologies in Malaysia.

Results from this qualitative part of study also support this point. One interviewee explained that "between 2005 and 2007, I was involved in a solar project and performed some site visits. I remember that one main and common complaint of stockholders and developers was the lack of skilled technicians, installers, and maintenance personnel." Another respondent mentioned that the "absence of trained staff to install and maintain renewable energy equipment was one of the main reasons for failing RE projects. A good example of this failure was the SREP program, which during the 8th Malaysian plan, only achieved 4% of the target."

Second, among other possible explanations, This result may also be explained by the fact that public has not access to valid information about RE and little effort has been put into shaping public opinion to support renewable energy policy in Malaysia. It is important to note that in order for technology transfer to happen successfully, there first needs to be a clear idea of the potential market for the use of that technology and a desire for the services it provides.

There is often a lack of accurate information on the potential renewable energy resources available, and the energy requirements of communities and businesses are poorly understood by foreign organizations. Also, if potential end users are not aware of the services that the technology can provide, there will be no demand for them. Lack of information regarding quality and standards of technology can be a problem as it means

that users, installers and developers are not able to distinguish between good and bad equipment and to make informed choices.

Third, Lack of knowledge is also likely to be related to inadequate research and development (R&D). After announcing the Five Fuel Policy and setting the 5% target for renewable energy, government budget appropriations for environmental R&D should have increased, but the opposite occurred. According to the Malaysian Science and Technology Information Center, in 2002, the total R&D expenditure in Malaysia was 0.69% of the GDP, while in 2006 this value declined to 0.64% of the GDP. In the energy sector, government R&D programs and R&D pursued by utility companies play a vital role in generating knowledge. Thus, the lack of funding for new knowledge creation in renewable energy technologies may have allowed detrimental "business-as-usual" scenarios to persist.

Four, weakness in environmental education in Malaysia can be considered as another reason for our results. "Many reasons account for the poor public awareness and low civic consciousness that spawned environmental deterioration in the country. Among them are: poor understanding and education on environmental issues, lack of knowledge and lack of information. Many are still unaware of environmental problems affecting or produced by them. Although they may feel vaguely uneasy, most do not care unless directly affected" (Yusoff, 2003).

Besides that, there is a dearth of information on environmental problems in the country; studies done are unavailable to the public; and very little effort is undertaken to make easily available the full facts of our environmental problems (Yusoff, 1997). Environmental education in Malaysia should be geared towards achieving sustainable development. Even though environmental education can be carried out in both non formal and formal ways, the focus should favour the educational institutions including schools

and universities in implementing an environmental syllabus. (National Council for Science and the Environment (NCSE, 2000).

In Malaysia, Environmental Education (EE) was introduced in national system of Education, starting from standard 3 to 6 in primary schools. Later at secondary level, pupil will learn environmental education through Geography subject for another three years. Unfortunately, once they reached SPM and STPM level, the Geography will be an elective subject. Students might neglect EE and it is due to their own interest (Habibah Lateh, et. al., 2009).

Five, these results are likely to be related to the fact that sometime the public actually avoids information. This could include fear of bad news, fear of failure, or fear of increased uncertainty, fear of being incapable of making adequate decisions. Another explanation may be the principle of least effort: people can reduce effort by avoiding information acquisition and processing (Payne et al., 1993).

Six, according to Marsh and Wallace (2005) the fact that "people do not use information to change their opinion in a positive direction" is a mechanisms which could block the positive effect of knowledge on acceptance.

Seven, the multi-cultural nature of Malaysian society was also can be mentioned as one explanation for rejecting the impact of knowledge on PEOU. In regard to gaining public support for any policy, including RE policy, taking the multi-cultural factor into account increases the chance of success of gaining such support. One of the interviewees in qualitative part of this study highlighted this issue and indicated that the "multi-cultural factor can either be a social barrier or a driver of their implementation.

Unfortunately, during the 8th and 9th developing plan, this factor had no place in the plan and implementation of RE policy." The local culture, religion and superstitions need

to be understood when projects are planned, in order to avoid problems later in the development stages. The ability and willingness of the community to accept practices and concepts that may be alien to their culture.

Eight, the lack of cutting edge technology is a further barrier which can affect the knowledge of people abut RE. In this area results from qualitative study might be useful. One interviewee illustrated that "when Malaysia decided to move toward renewable energy in 2000, RE technology in Malaysia was in its infancy, and further development largely depended on massive transfers of relevant technologies from developed countries, which has yet to occur."

As a sign of this lack of technology commitment, one respondent referred to the Malaysian prime minister speech at the United Nations Climate Change Conference 2009 in Copenhagen and highlighted that "the Malaysian prime minister in 2009 clearly asserted that Malaysia needed access to a massive transfer of technology, including RETs for addressing climate change, which meant that during the years before 2009, the absence of green technology for renewable energy in particular was evident in Malaysia." The lack of technical standards is also considered one of the technology related problems. An interviewed noted that "in some RE projects, such as solar projects, the absence of technical standards led to the installation of poor-quality technology."

The identification of existing barriers due to the technical standards in Malaysia is consistent with those of Ölz and Beerepoot (2010), who found that the lack of standards was a significant technology related barrier among the majority of ASEAN members. Note that this barrier is a common challenge for RET-importing countries.

It is important to note that the knowledge, to some extent, overlaps with other issue, such as economic and politic. Weak plans and unrealistic targets in terms of the

implementation of renewable energy and attracting public support and generating need knowledge were also addressed by the respondents. For example, one interviewee argued that "setting a 5% target for renewable in energy in the 8th Malaysian plan was unrealistic and so ambitious." This opinion was echoed by another respondent, who mentioned that "I do believe setting the 5% target for RE was not defendable, because at that time, the Malaysian situation in terms of infrastructure, public opinion, government fiscal policy, local banks, and the availability of related technology were not ready for this target." Likewise, other respondents noted that "our renewable energy plan and targets were not holistic and believable. Therefore, investors, suppliers and developers were frightened that adequate support might not be made available and were less likely to invest time and money in developing RETs."

These finding are corresponding to the Al-Badi et al. (2009) finding. They found that renewable energy development in Oman is facing a number of policy and administrative barriers. One academician with economic background explained that "the lack of awareness by probable users in Malaysia resulted in the lack of demand and marketing for this technology. Without the availability of marketing, the local market for renewable energy was not attractive for the private sector. Thus, there was no intention from the private sector to financially support renewable energy."

The lack of knowledge about renewable energy could be rooted in political barriers as well. As a case in point, the relationship between inadequate R&D and the lack of knowledge for RE can be the result of political barriers.

It is worth to mention that in the questionnaire used in this study, respondents were also asked to give their views on measures that could be taken by the government to increase public awareness of environmentally friendly practices and green technology products (see Table 5).

The results demonstrate that the public recommended three measures in particular. These measures included introducing environmental and technology curriculum at all levels of school (mean 4.26), improving environmental campaigns and the portrayal of green technology in mass media and social media (mean 4.24), and introducing a one-stop center/agency to disseminate information on green technology (mean 4.09).

In general, therefore, it seems that in peninsular Malaysia there is a positive relation between knowledge and acceptability of RE products and acceptance-related measurements. This study, therefore, has helped to encourage effort to increase and improve knowledge of renewable energy and the public perception towards the technology.

The present results are significant in at least two major respects. First current research added important pieces of empirical evidence in literature on the public knowledge of renewable energy in Malaysia. Second, this study indicate that not only increasing knowledge should be take into consideration but also the quality of knowledge also is important.

6.6 Cost, PU, PEOU and Attitude toward using RE

Another part of the third objective in this research was the impact of cost on attitude towards using and accepting RE. According to Huijts et all (2012) "costs of the technology can include personal financial costs such as the costs of purchasing or using the technology or societal costs such as subsidies needed to make the initial investments cost effective." A considerable amount of literature has been published on the impact of economic and/or financial barriers on development of RE technologies. For example, Pohekar et all (2005) reported that using biogas and solar energy for cooking have high initial cost. Barua (2011) also mentioned that high cost of solar PV module has been the main barrier to Bangladesh's PV program. However there is little published data on the role of cost on RE acceptance in Malaysia.

In the current research, Modelling results suggest that the cost of renewable energy has an indirect effect on attitudes towards using renewable energy through associated impacts on PU and PEOU. These relationships may be clarified by three explanations.

First, a possible explanation for this might be that Malaysia is among the nations with the highest fossil fuels subsidies. A subsidy, is "a result of a government action that confers an advantage on consumers or producers, in order to supplement their income or lower their costs". It is important to note that different literature has emphasized the importance of subsidized conventional energy sources as creator of market distortions favouring conventional energy sources (Martinot, 1999; Ruble I & El-Khoury, 2013; McCormick & Kaberger, 2007; Lidula et al, 2007; Ohunakin et al, 2014).

Malaysia like other countries in Southeast Asia has a "long history of providing subsidies that lower the price paid by energy consumers to below international market levels, or in the case of electricity generated from fossil fuels, to below levels that cover the full cost of supply." According to Beaton et all (2013) "Malaysia subsidizes all fuel types except for fuel and in 2005-2010", spent at least US$ 21 billion on fuel subsidies.

Subsidies for fossil fuels have resulted in market failure and made it difficult for renewable energy technologies to compete economically. Subsidized projects, often funded by multilateral or donor aid, distort local commercial markets and can harm or destroy local industry. When the 8th Malaysian plan announced the government's intention to move toward renewable energy, it was hoped that fuel subsidies would be gradually cut in favour of renewable and clean energy; however, the share of fuel subsidies in the total government subsides increased significantly. Fig. 6.1 provides more details concerning fuel subsidies in Malaysia between 1990 and 2010. Note that in 2007, energy subsidies in Malaysia were the second largest in the ASEAN region (after Indonesia) and exceeded 8 billion USD.

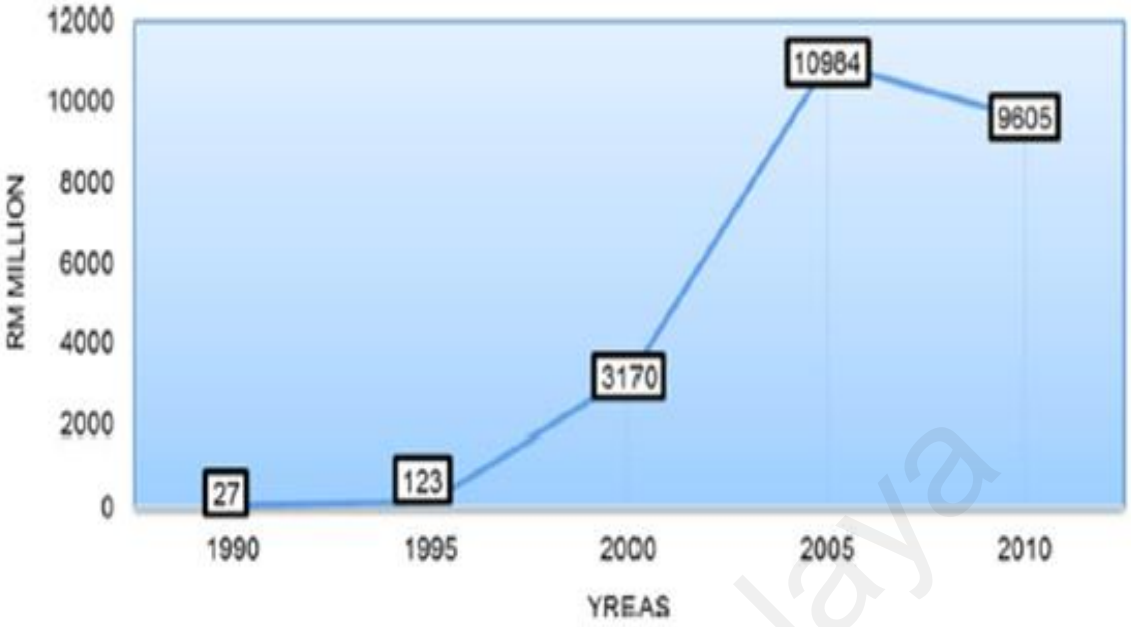

Figure 6.1: The fuel subsidy trend in Malaysia
Source: Beaton et all (2013)

It is a widely held view that spending on subsidies often becomes a serious burden on Malaysian government resources. Subsidised energy prices in Malaysia is restricting investment in energy infrastructure by depriving energy companies of the revenues needed for new investment. Subsidies in Malaysia have also meant that refined product prices have been well below the regional average.

Analysing data from qualitative part of this study also indicate that providing subsidies for fossil fuels was one of the key economic related barriers in Malaysia regrading accepting RE technology. It is widely believed that as long as fossil fuels are subsidised or that their prices fail to reflect their ecological costs, renewable energy sources will not be commercially feasible.

Most interviewees agreed that economic barriers to the advancement of RETs existed in Malaysia and led to the failure of RE policies in this regards. The present findings are consistent with other research, which found that subsidies impede the diffusion of RETs (Sovacool & Drupady, 2011; Owen, 2006; Painuly, 2001).

Second, another possible explanation is related to the electricity price. In Malaysia the electricity price was low and because of inadequate tariffs, renewable energy products could not sell in the market at a profitable price. Fig. 6.2 shows the electricity prices for selected countries. This issue is cited by the respondents is qualitative data as well. For example, one interviewee said: "the tariffs paid to RE developers were not based on sound economic principles."

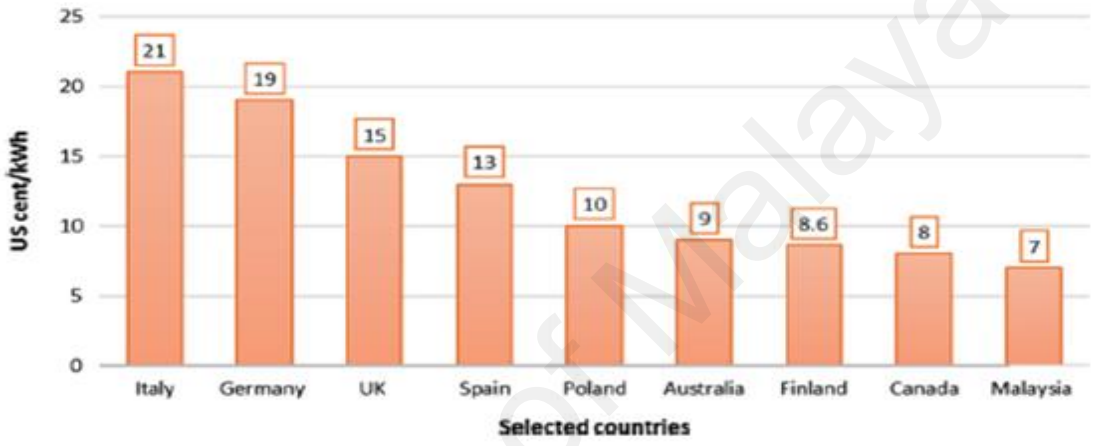

Figure 6.2: Average electricity price for selected courtiers
Source: Beaton et all (2013)

This view is supported by Sovacool at all (2011) who writes that insufficient tariffs is a main cause for failure of The Small Renewable Energy Power (SREP) Program which was one of the premier policy mechanism in Malaysia. It is important to note that "the Malaysian Small Renewable Energy Power (SREP) Program attempted to install 500 MW of additional qualified biomass, biogas, municipal solid waste, solar photovoltaics, and mini hydroelectric facilities from 2001 to 2005, but ended up achieving only 12 MW of capacity by the end of 2005" (Sovacool,& Drupady,2011, p.7244).

Malaysian planners altered the SREP by lowering its target to 350 MW and extending it for another 5 years, but by the end of 2010 just 11 projects and 61.7 MW of capacity had been built. This finding also is in line with the findings of Seng et al. (2008), who

reported that in Malaysia, owners of PV systems were not able to make any financial return on their investment, and as a result, the current size of the PV market was very small.

Interviewee from the qualitative part of this study also noted that electricity tariffs in Malaysia were low and did not account for the external costs. They also noted that renewable energy producers could not trade their power to the market at a profitable price due to insufficient tariffs. They indicated that to make projects feasible for RE projects, the rate currently offered would be needed to increase.

Third, this result is likely to be related to the difficulty to obtain bank financing as well. Renewable energy installers need access to money, but because of the lack of sufficient assets, the banks have not cooperated with them. This element has also been mentioned by interviewees as an economic barrier. The interviewees indicated that economic barriers hampered the development of renewable energy during the 8th and 9th Malaysian plans. All in all, in terms of economic barriers, the economic ethos of Malaysia was not supportive for renewable energy, especially for providing a balance between costs and benefits.

These results of this study further support the idea about the role of cost on RE acceptance (Jarach, 1989; Quadir et al, 1995; Agarwal, 1983; Green, 1993; Oliver, 1999; Rijal, 1999; Painuly, 2001; Pokharel, 2003; Foxon, 2005). In general, therefore, it seems that in terms of cost, the economic ethos of Malaysia does not support renewable energy, especially in terms of providing a balance between costs and benefits.

6.7 Conclusion

In this chapter we discussed the major findings of Peninsular Malaysian public awareness about climate change and Re technology as well as the overall relationships

among the external variables (cost and knowledge), predictor variables (PU and PEUO) and the outcome variable (Attitude toward using RE). The suggested model in this thesis assisted to define these relations. This section studied the effects of cost and knowledge in acceptance of RE technology.

The next chapter concludes the results of the study and provides some recommendations for policy makers regarding Re technology acceptance in Peninsular Malaysia.

CHAPTER 7: CONCLUSION

7.1 introduction

The Malaysian government has begun to focus on renewable energy to address the climate change challenge and meet energy needs in a sustainable way. Renewable energy was first announced in the country's energy mix through the Fifth Fuel Policy under the 8th Malaysian Plan.

Over the past 14 years, the government of Malaysia has applied many different policies to promote the implementation of renewable energy as an alternative energy. Despite the continuous efforts to develop renewable energy, renewable energy is not yet utilized to its maximum potential in Malaysia, and the implementation of renewable energy policy has received a sluggish response.

By proposing a technology acceptance framework, this study set out to understand the public's acceptance of renewable energy technologies in Peninsular Malaysia, as public acceptance of renewable energy technology is an essential element for diffusion and development of renewable energy. The study sought to address four objectives:

1. Determine the level of public awareness on the issue of global climate change and the use of renewable energy technology in Peninsular Malaysia.
2. Evaluate the impact of perceived of usefulness and perceived ease of use on the renewable energy acceptance in Peninsular Malaysia
3. Evaluate the impact of cost and knowledge on the renewable energy acceptance in Peninsular Malaysia.
4. To test the proposed research model (RE acceptance) in a Peninsular Malaysia context.

To this end, a structure equation model was employed to analyse data collected by surveying residents' intentions to use renewable energy in four regions of Peninsular Malaysia. This represents the first study reporting the applicability of technology

acceptance models in Malaysia, as most previously published studies have focused on data from western countries (e.g., Sweden, the UK). To support the results of quantitative finding, in this thesis, qualitative study using semi structure interview has been applied as well.

The final chapter of this dissertation is divided into eight parts. Following the introduction section 7.2, section 7.3 presents the key findings and research contributions of this study. The next section (7.4) is about theoretical and managerial implications followed by policy implication (7.5), recommendation for future research (7.6), limitation of the study (7.7) and conclusion (7.8).

7.2 Empirical finding

The main empirical findings are specific summarized within the respective empirical chapter six. This section will synthesize the empirical findings to answer the study's four research questions.

This study shows that citizens in Peninsular Malaysia are adequately informed about the issue of climate change. The results also show that the percentage of the public who use renewable energy products is the highest among those who are familiar with such products. One interesting finding was that the level of concern about the climate change in peninsular Malaysia is approximately equal to population in developed countries like UK and USA.

The most obvious finding to emerge from this study was despite the fact that attitude of respondents in Peninsular Malaysia is generally positive towards renewable energy technologies, four out of five people in Peninsular Malaysia believe that the cost of renewable energy products is high.

Moreover, this study found that the public's knowledge about government policies involving renewable energy is low, and the majority of people who have information about these policies felt that they are not successful and effective.

This study has shown that PU is an important factor in influencing the intention to use renewable energy. The second major finding was that PEOU is also an important factor affecting the intention to use renewable energy.

These findings enhance our understanding of the barriers to developing renewable energy in Malaysia. Evaluate the impact of cost and knowledge on the renewable energy acceptance in Peninsular Malaysia.

The results of the SEM analysis confirm the expectancy that the attitude to use renewable energy is influenced by the cost of renewable energy technology. Cost affects users' motivation for using renewable energy by its indirect impact on PU and PEOU.

It is therefore important that the cost of renewable energy products to be reduced, especially for end users. Knowledge concerning renewable energy has been found to be an important factor affecting attitudes towards using renewable energy only through its indirect impact on PU.

The results for this factor indicate the hypothesis that claims the knowledge positively affects PEOU should be rejected, and only the positive impact of knowledge on PU is supported.

In this study, Structural equation modelling (SEM) is used to test the proposed model arising from the theoretical framework which is based on technology acceptance model.

The proposed model for this study can be seen in Fig. 7.1which is consisted of five constructs including knowledge, cost, PU, PEUO, and attitude toward using RE.

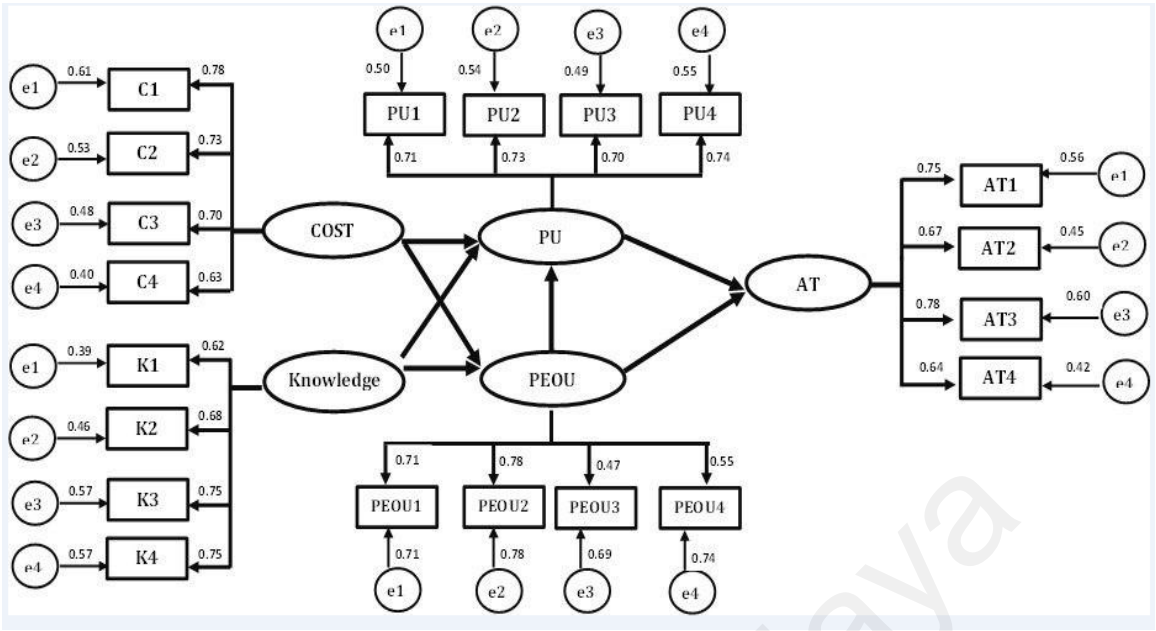

Figure 7.1: Proposed model

This hypothesized model (original structural model) which include seven paths (H1, H2. H3, H4, H5, H6, H7) was tested. As described in chapter 6, two hypotheses were found to not be statistically significant and rejected. Consequently, the model was respecified by deleting abovementioned path. Then the goodness-of-fit indices are examined to assess if the new structural model (re specified) fits the data. Conducting CFA and analysing the results, and all fit indices suggest that the covariance structure constructed in the substantive model fits the data acceptably. Based on the empirical evidence and theoretical discussion, it was found that the best parsimonious model was fig 7.2.

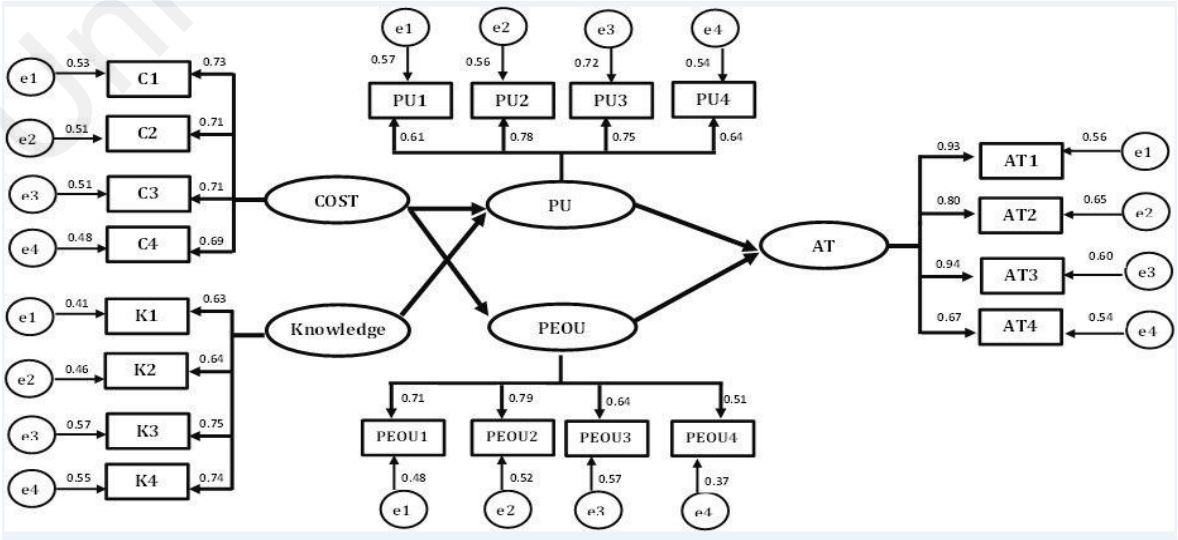

Figure 7.2: Final structure model

7.3 Major Areas of Contribution

This research expects to contribute to the body of knowledge in a number of ways. The major areas of contribution are as follows:

1. This research extends our knowledge of public awareness regarding climate change, green technology, and renewable energy in peninsular Malaysia. In order to minimize the problems and maximize the expected results of renewable energy planning, and prior to making strategic plans and governmental decisions, it is imperative to research public awareness. In this way, the risk of failed governmental decisions can be minimized. The findings of this thesis could be used to help energy policymakers.
2. From the theoretical perspective, this study examines the technology acceptance model to gain a better understanding of the public intention to use renewable energy in peninsular Malaysia. This represents the first study on the applicability of technology acceptance models in Malaysia, as most studies have focused on data from Western countries.

   This study enhances our understanding of the important role public knowledge plays in renewable energy acceptance in Peninsular Malaysia.

   To explore the elements impressing the acceptance of RE technology in Peninsular Malaysia in this study, the concept of RE policy development inside the technology acceptance theory was used. In terms of qualitative approach, so far, these are the fresh contributions which is validated by the result of quantitative study.
3. The validation of the proposed conceptual schema in theoretical model was run by the use of explanatory power and achieving good fit to the data. Hence, the contribution of the carried out research to the literature is evaluating most of the constructs in the comprehensive model. Incorporating a developing country

perspective with theoretically valid recognition as well as apprehension is another contribution of the current research to the literature. As this was largely overlooked in international business literature, this lends support to the vast developed country based extant scholarly activities. The study contributes to the literature by incorporating Malaysian data into empirical generalizations of other findings in which renewable energy acceptance also makes significant contributions.

7.4 Policy implication

A number of policy recommendations can be extracted from the findings. First, the results of this study may motivate policy makers to pay more attention to the role of public perception and awareness in the successes and failures of renewable energy policy. There is, therefore, a definite need for increasing the awareness of the public about the costs and benefits of renewable/sustainable energy technologies through suitable programs and campaigns.

Another important practical implication is that education and material dissemination related to renewable energy should be introduced at all school levels and information from resource studies about various renewable technologies should be made available through government programs and initiatives.

Third, considering the fact that in the energy sector, government R&D programs play a vital role in the development of renewable energy technology (Jacobsson and Johnson, 2000), a key government priority should be to increase budget appropriations for environmental R&D.

Moreover, efforts are needed to contribute to local knowledge, which is knowledge that is "practical, collective and strongly rooted in a particular place" (Geertz, 2000), and to stimulate the policymaking process from problem definition and policy formulation to policy implementation and policy evaluation.

Considering the fact that citizen awareness and involvement in government projects and initiative is often lacking. The hierarchy and decision-making process in the community needs to be understood.

The social fabric of the community needs to be understood when selecting technicians and fee collectors; these people, organizations or groups must be respected by the community if the projects are not to face difficulties.

Therefore, it is important to note that in the policymaking process political culture, socioeconomic conditions, and participants such as those working with mass media, interest groups, citizen initiatives, elites, and civil society are the elements that can affect the successfulness or unsuccessfulness of specific policies.

Therefore, if renewable energy policy in Malaysia wants to be successful, it will be inevitable to take into consideration all the above-mentioned factors that have made it difficult for renewable energy technologies to compete economically. Policy makers could strengthen the benefits of the RE technology and the way it is implemented. This can be done by making the technology more beneficial for society and the environment by allocating the costs, risks and benefits as fairly as thinkable.

In addition, adequate information about RE should be provided for people by government. "One cannot be the adoption process without knowing about the innovation. In this stage, a person first becomes aware of the technology".

Best way to diffusion of knowledge and information is organizing social dialogue especially by using the potential of civil society and uses of other mode of communications such as by mosque, church, and worship place.

Last but not least if government aim to promote the use of RE technology they should remove or reduce distortionary subsidies for fossil fuel. To do so it is crucial to avoid politicization of discussion about fossil fuel subsidies.

7.5 Limitations of the study

This research is confined to analyses and investigation of renewable energy technology acceptance in Peninsular Malaysia. The review of the literature suggests that there is a wide range of issues that might have some impact on renewable energy acceptance.
For instance, Huijts et al. (2012) introduce a model for which other factors in the acceptance of energy technology, such as intention to act, subjective norm, and personal norms, must be taken into consideration.

To keep this study within manageable proportions and maintain parsimony, only five factors (cost, knowledge, perceived usefulness, and perceived ease of use and attitude toward using technology) have been included in this study. In addition, due to time and resource constraints, this study explores only subjects in western Malaysia (Peninsular Malaysia).

Since collecting data for survey in this study was cross sectional it is needed for the future investigation longitudinal data to be provided to examine the factors the influences citizen in continuing acceptance of RE technology in Peninsular Malaysia Moreover, this study focused on a specific technology (RE technology), local users (citizen in peninsular Malaysia) and specific location (Peninsular Malaysia).

Last but not least in this study the data have been collected only from citizens. This might not explore the total picture of Re technology acceptance among costumers in all respects.

7.6 Future Research Directions

First, result of this study shows that knowledge only affects PU, further studies are needed to validate the impact of knowledge on PU and PEOU.

Second, the current study examined research questions for the first time in Peninsular Malaysia (west Malaysia). Therefore, some of the findings are not only thought-provoking new evidence but also uncertain unless verified in any further studies. Thus it

is recommended that further researches to be undertaken by collecting data from whole Malaysia including east Malaysia.

In further research, collecting data from different country contexts especially developing countries such as Iran, Indonesia, Thailand and India could be valuable to validate the findings.

For future research to expand the research model, questions that could be asked might be include influence of additional external variables (independent) such as trust, experience, personal and social norms on accepting Re technology.

Selection of other dependent variables like behavioural intention and actual usage of RE technology rather than attitude toward using RE could be another direction for further research.

This study only concentrations on citizen' perspectives in terms of RE technology acceptance rather than consumer, stockholder and businessmen. Hence, any future study could be grappling with all related groups.

Finally, and more precisely, the study has developed some of the construct measures and all of those are found to be reliable and valid in the present context but these are tentative unless verified and refined in a new research context.

In particular, using the cultural similarity measurement was a new challenge because all extant studies have so far used the cultural index, so that this represents a significant attempt to verify and refine this measure.

Further, measurement of the supplier's competencies, and knowledge and experience also represent new research directions and these were found to be reliable and valid in the present context. Any similar research direction should include these measures to test further reliability and validity.

7.7 Conclusion

To answer the basic research question and to achieve the research objective, this study developed a basic conceptual model, a competing model and a framework for conceptual insight.

Based on sound reasoning of modification indices in SEM analysis, both (the proposed and competing) models were tested as modified models and compared with the overall measurement model to identify the better fitted model.

This identified the modified proposed model as parsimonious and comparatively better with explanatory power as well as fitting the data and the theory.

This study indicated that failure of the five fuel policy in Malaysia is a multi-aspect phenomenon. The important point is therefore not to cling to one or two barriers but to use the groups of barriers to explain this failure.

This study also revealed the interrelationship of the issue to renewable energy development in Malaysia. One of the most important lessons is the requirement of addressing both economic and knowledge issue.

From the analysis of the opinions of the respondents, it can be said that best way to overcome these issue is that the government should play a powerful leadership role.

More research is also needed to determine how social acceptance for renewable energy can be created in the Malaysian multi-ethnic society and to determine how non-government organizations and the media can play a role in this area.

The current study examined public opinion about climate change and renewable energy policies in Peninsular Malaysia (west Malaysia). It is recommended that further research be undertaken by collecting data from east Malaysia.

The results of this survey may motivate policy makers to pay more attention to the role of public perception and awareness in the successes and failures of renewable energy

policy. This study has raised our understanding about important role of public knowledge in renewable energy acceptance in Peninsular Malaysia.

There is, therefore, a definite need for increasing the awareness of the public about the costs and benefits of renewable/sustainable energy technologies through suitable programs and campaigns.

REFERENCES

Aaker, D.A., Kumar, V. and Day, G.S. (1998), Marketing Research, 6th edn. John Wiley & Sons, Canada

Achterberg, P., Houtman, D., Van Bohemen, S., & Manevska, K. (2010). Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in the Netherlands. *International Journal of Hydrogen Energy*, *35*(12), 6075-6083.

Adams, D.A., Nelson, R.R. & Todd, P.A. (1992) "Perceived Usefulness, Ease of Use, and Usage of Information Technology - a Replication", MIS Quarterly, vol. 16, no. 2, pp. 227-247.

Adi Nugroho. (2010). Rekayasa Perangkat Lunak Berbasis Objek dengan Metode.

Agarwal, B. (1983). Diffusion of rural innovations: some analytical issues and the case of wood-burning stoves. World Development, 11(4), 359-376.

Ahlan, A. R., & Ahmad, B. I. E. (2014). User acceptance of Health Information Technology (HIT) in developing countries: A literature review.

Ahmad S, Kadir MZAA, Shafie S ,(2011), Current perspective of the renewable energy development in Malaysia. Renew Sustain Energ Rev 15(2):897–904.

Ahmad, S., & Tahar, R. M. (2014). Selection of renewable energy sources for sustainable development of electricity generation system using analytic hierarchy process: A case of Malaysia. Renewable energy, 63, 458-466.

Akter, S. and Bennett, J. (2011) Household perceptions of climate change and preferences for mitigation action: the case of the Carbon Pollution Reduction Scheme in Australia. Climatic Change 109 (3–4), 417–436.

Akter, S., Bennett, J., & Ward, M. B. (2012). Climate change scepticism and public support for mitigation: evidence from an Australian choice experiment. Global Environmental Change, 22(3), 736-745.

Alam, S.S., Hashim, N.H.N., Rashid, M., Omar, N.A., Ahsan, N., Ismail, M.D, (2014). Small-scale household's renewable energy usage intention: theoretical development and empirical settings. Renew. Energy 68, 255–263.

Al-Badi, A. H., Malik, A., & Gastli, A. (2009). Assessment of renewable energy resources potential in Oman and identification of barrier to their significant utilization. Renewable and Sustainable Energy Reviews, 13(9), 2734-2739.

Amin, N., Lung, C. W., & Sopian, K. (2009). A practical field study of various solar cells on their performance in Malaysia. Renewable Energy, 34(8), 1939-1946.

Amoako-Gyampah, K. (2007). Perceived usefulness, user involvement and behavioral intention: an empirical study of ERP implementation. Computers in Human Behavior, 23(3), 1232-1248.

Anderson, C., & Gerbing, W. (1988), "Structural equation modelling in practice: a review and recommended two-step approach", Psychological Bulletin, 103:411-423.

Anderson, J. C., & Gerbing, D. W. (1982). Some methods for respecifying measurement models to obtain unidimensional construct measurement. Journal of Marketing Research, 19(4), 453-460

APEC (Asia Pacific Energy Research Centre). (2009). APEC Energy demand and supply 4th edition. Available from: <www.ieej.or.jp/aperc>.

Arbuckle, J.L. (1999) Amos 4.0 [Computer Software]. Small waters: Chicago

Arbuckle, J. L. (2005). Amos 6.0 User's Guide. Spring House, PA: Amos Development Corporation.

Byrne, B. M. (2001). Structural Equation Modelling with Amos: Basic Concepts, Applications, and Programming. Mahwah, NJ: Erlbaum

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. Journal of The Academy of Marketing Science, 16(1), 74-94.

Barua, D. C. (2001). Strategy for promotions and development of renewable technologies in Bangladesh: experience from Grameen Shakti. Renewable Energy, 22(1), 205-210.

Beaton, C., Gerasimchuk, I., Laan, T., Lang, K., Vis-Dunbar, D., & Wooders, P. (2013). A guidebook to fossil-fuel subsidy reform for policy-makers in Southeast Asia. IISD-GSI.[enlínea]http://www.iisd

Beedles, M.T.F. (2002) the Uncertain Role of Alliances in the Strategic Armoury of the Dominant Firms in the Global Pharmaceutical Industry. Unpublished Doctoral Thesis, Queensland University of Technology, Brisbane, Australia.

Bentler, P.M. (1995), EQS Structural Equations Program Manual, Encino, CA: Multivariate Software.

Bentler, P.M. and Bonnet, D.C. (1980), "Significance Tests and Goodness of Fit in the Analysis of Covariance Structures," Psychological Bulletin, 88 (3), 588-606.

Billatos, S. (1997). Green technology and design for the environment. CRC Press.

Blaikie, N. W. (1991). A critique of the use of triangulation in social research. Quality and quantity, 25(2), 115-136.

Bollen, K. A. (1989), Structural Equations with Latent Variables, New York: Wiley.

Bord, R. J., Fisher, A., & O'Connor, R. E. (1998). Public perceptions of global warming: United States and international perspectives. Climate Research, 11(1), 75-84.

Borick, C. P., Lachapelle, E., & Rabe, B. G. (2010). Climate compared: public opinion on climate change in the United States and Canada. People.

Bourque, L. B., & Fielder, E. P. (2003). How to conduct self-administered and mail survey. In A. Fink (Ed.), the Survey Kit (2ed ed., Vol. 3). Thousand Oaks, Calif: Sage Publications.

Brechin1, S. R. (2003). Comparative public opinion and knowledge on global climatic change and the Kyoto Protocol: the US versus the world?. International Journal of Sociology and Social Policy, 23(10), 106-134.

Bujang, A. S., Bern, C. J., & Brumm, T. J. (2016). Summary of energy demand and renewable energy policies in Malaysia. Renewable and Sustainable Energy Reviews, 53, 1459-1467.

Burton, I., Diringer, E., & Smith, J. (2006). Adaptation to climate change: international policy options. Arlington, VA: Pew Center on Global Climate Change.

Byrne, B. M. (2001). Structural Equation Modelling with Amos: Basic Concepts, Applications, and Programming. Mahwah, NJ: Erlbaum.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological bulletin, 56(2), 81.

Canning, D., & Fay, M. (1993). The effect of transportation networks on economic growth. manuscript, Columbia University.

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N.F. & Upham, P. (2015). International trends in public perceptions of climate change over the past quarter century. Wiley Interdisciplinary Reviews: Climate Change, 6(1), 35-61.

Carmines, E. G., & McIver, S. P. (1981). Analysing models with unobserved variables: Analysis of covariance structure. In G. w. Bohrnstedt & E. F. Borgatta (Eds.), Social Measurement: Current Issues. Beverly Hills: Sage.

Catania, J. A., Binson, D., Canchola, J., Pollack, L. M., Hauck, W., & Coates, T. J. (1996). Effects of interviewer gender, interviewer choice, and item wording on response to questions concerning sexual behaviour. Public Opinion Quarterly, 60(3), 345-375.

Chandio, F. H. (2011). Studying acceptance of online banking information system: A structural equation model (Doctoral dissertation, Brunel University Brunel Business School PhD Theses).

Chiang, E. P., Zainal, Z. A., Narayana, A., & Seetharamu, K. N. (2003). Potential Of Renewable Wave And Offshore Wind Energy Sources In Malaysia.

Chou, S.K.(2008). Regional perspective: the challenges ahead for renewable energy in Southeast Asia. In: Presentation to the International Conference on New Developments in Renewable Energy, Bangkok, Thailand, June 4.

Chou, K. T. (2013). The public perception of climate change in Taiwan and its paradigm shift. Energy Policy, 61, 1252-1260.

Chua, S. C., & Oh, T. H. (2010). Review on Malaysia's national energy developments: Key policies, agencies, programmes and international involvements. Renewable and Sustainable Energy Reviews, 14(9), 2916-2925.

Churchill, G.A. 1(987), Marketing Research: Methodological Foundations, Fifth edition, The Dryden Press, New York, USA.

Chuttur MY (2009) Overview of the technology acceptance model: Origins, developments and future directions. Sprouts: Working Papers on Information Systems 9 (37), 9-37.

Coakes, S. J. (2006). SPSS: Analysis Without Anguish: Version 14.0 for Windows. Milton, Qld: John Wiley & Sons.

Cochran, W. G. 1963. Sampling techniques.

Cohen, J. & and Cohen, P. (1983) Applied multiple regression/correlation analysis for the behavioral science, 2nd edn, Hillsdale, NJL Lawrence Erlbaum.

Cooper, D. R. & Schindler, P. S. (2001). Business research methods. New York: McGrew-Hill Companies.

Coorley, W. W. (1978). Explanatory observation studies. Educational Researcher (October), 9-15.Lei, P. W. and Wu, Q. An NCME Instructional Module on Introduction to Structural Equation Modelling: Issues and Practical Considerations, Educational Measurement, Issues and Practice, 26, 3, 2007, pp. 33-44.

Corner, A., Venables, D., Spence, A., Poortinga, W., Demski, C., & Pidgeon, N. (2011). Nuclear power, climate change and energy security: exploring British public attitudes. Energy Policy, 39(9), 4823-4833.

Creswell, J. W. (1994). Research Design: Qualitative and Quantitative Approaches. Thousand Oaks: Sage Publications.

Cronbach, L. J. (1951),"Coefficient Alpha and the Internal Structural of Tests", Psychometrica, 16(3): 297-334.

Davis, F., Bagozzi, R. & Warshaw, P. (1989) "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models", Management Science, vol. 35, no. 8, pp. 982-1003.

De Groot, J. I., Steg, L., & Poortinga, W. (2013). Values, perceived risks and benefits, and acceptability of nuclear energy. Risk Analysis, 33(2), 307-317.

Denzin, N. K. (1970). The research act in sociology.

Denzin, N. K. (1973). The research act: A theoretical introduction to sociological methods. Transaction publishers.

Department of Trade and Industry, Scottish Executive et al. (2003) Attitudes and Knowledge of Renewable Energy amongst the General Public

De Vaus, D. A. (1995). Surveys in Social Research (4th ed.). North Sydney: Allen and Unwin.

De Wulf, K., Odekerken-Schröder, G., & Van Kenhove, P. (2003). Investments in consumer relationships: A critical reassessment and model extension. The International Review of Retail, Distribution and Consumer Research, 13(3), 245-261.

Duan, H. (2010). The public perspective of carbon capture and storage for CO 2 emission reductions in China. Energy Policy, 38(9), 5281-5289.

Duan, Y., Nie, W., & Coakes, E. (2010). Identifying key factors affecting transnational knowledge transfer. Information & management, 47(7), 356-363.

Ellis, G., Barry, J and Robinson, C. (2006) Renewable energy and discourses of objection towards deliberative policy making. Summary of main research findings. Queen's University Belfast. ESRC grant reference: 000-22-1095. Available at the following website: http://qub.ac.uk/research-centres/REDOWelcome/EPU, 2010

Fishbein, M., Ajzen, I., (1975), "Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research", Addison-Wesley, Reading, MA.

Fornell, C. & Larcker, D., F. (1981), "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error", Journal of Marketing Research, vol. 18, no. 1, pp. 39-50.

Foxon, T. J., Gross, R., Chase, A., Howes, J., Arnall, A., & Anderson, D. (2005). UK innovation systems for new and renewable energy technologies: drivers, barriers and systems failures. Energy policy, 33(16), 2123-2137.

Frazer, L. and Lawley, M. (2000), Questionnaire Design and Administration: A practical Guide, John Wiley & Sons Australia, and Singapore.

Gay, L.R and Airasian, P. (2000), Educational Research, Competencies for Analysis and Application, Sixth Edition, MERRIL an Imprint of Prentice Hall.

Geertz, C. (2000). Local knowledge: Further essays in interpretive anthropology (Vol. 5110). Basic books.

Gerbing, D.W. and Anderson, J.C. (1993), Monte Carlo evaluation of goodness-of fit indices for structural equation modeling, in KABSJ long (ed.), Testing Structural Equation Models, Sage Publications, Newbury Park.

Goh, C.S., Lee, K.T., (2010). Will biofuel projects in Southeast Asia become white elephants? Energy Policy, 38(8), 3847-3848.

Green, D. (1999). Cross cultural technology transfer of sustainable energy systems: a critical analysis. Renewable Energy, 16(1-4), 1133-1137.

Groves , R. M. (1990). Theories and methods of telephone surveys. Annual Review of Sociology, 16, 221-240

Gupta, N., Fischer, A.R.H., Frewer, L.J. (2011) Socio-psychological determinants of public acceptance of technologies: a review. Public Understanding of Science 21, 782-795.

Gupta, N., Fischer, A. R. H., & Frewer, L. J. (2012). Socio-Psychological Determinants of Public Acceptance of Technologies: A Review. Public Understanding of Science, 21(7), 782-795. doi: DOI: 10.1177/0963662510392485.

Lateh, H., & Muniandy, P. (2009). Environmental education (EE): current curriculum situational and the challenges at primary school, Malaysia (International Geographical Union (IGU), Commission of Geographical Education Tsukuba conference 2009: abstracts and proceedings). 新地理, 57, 23-29.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). Multivariate Data Analysis with Readings (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Hair, J. F., Anderson, R. E., Tatham, R. L., & William, C. (1998). Black (1998), Multivariate data analysis.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall.

Hair , J. F., Bush, R. B., & Ortinau, D. J. (2003). Marketing Research Within a Changing Information Environment. New York, NY: McGraw-Hill.

Han, S. (2003). Individual adoption of information systems in organizations: A literature review of technology acceptance model. Turku Centre for Computer Science (TUCS).

Hansen, M. H., Hurwitz, W. N., & Madow, W. G. (1953). Sample Survey Methods and Theor.

Harris, M. and Schaubroeck, J. (1990), "Confirmatory modelling in organizational behaviour/human resource management: issues and applications", Journal of Management, 16: 2.

Haris, AH & Ding, J (2009), Final Report on National Renewable Energy Policy and Action Plan. Kuala Lumpur, Malaysia: MBIPV Project c/o Pusat Tenaga Malaysia.

Hashim, H., & Ho, W. S. (2011). Renewable energy policies and initiatives for a sustainable energy future in Malaysia. Renewable and Sustainable Energy Reviews, 15(9), 4780-4787.

Hezri, A. A., & Nordin Hasan, M. (2006) February. Towards sustainable development? The evolution of environmental policy in Malaysia. In Natural Resources Forum (Vol. 30, No. 1, pp. 37-50). Blackwell Publishing Ltd.

Holmes-Smith, P (2002), Applied Structural Equation Modelling, Feburay, Canbera.

Holmes-Smith, P., Coote, L., & Cunningham, E. (2006). Structural Equation Modelling: From the Fundamentals to Advanced Topics. Melbourne: SREAMS.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. Articles, 2.

Hosseini, S. E., & Wahid, M. A. (2014). Utilization of palm solid residue as a source of renewable and sustainable energy in Malaysia. Renewable and Sustainable Energy Reviews, 40, 621-632.

House, L., Lusk, J., Jaeger, S., Traill, W. B., Moore, M., Valli, C. & Yee, W. M. (2005). Objective and subjective knowledge: Impacts on consumer demand for genetically modified foods in the United States and the European Union.

Hox, J. J., & Bechger, T. M. (1998). An introduction to structural equation modelling. Family ScienceReview, 11, 354-373.

Hoyle, R. H. (Ed.). (1995). Structural equation modeling: Concepts, issues, and applications. Sage Publications.

Hsieh, Y., Chiu, H., & Chiang, M. (2005). Maintaining a committed online customer: A study across search-experience-credence products. Journal of Retailing, 81(1), 75-82.

Hu, L.T. and Bentler, P.M. (1999), "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives," Structural Equation Modeling, 6 (1), 1-55.

Huijts, N., Molin, E., Chorus, C., & Van Wee, B. (2011). Public acceptance of hydrogen technologies in transport: a review of and reflection on empirical studies. Transition towards sustainable mobility: the role of instruments, individuals and institutions. Hampshire: Ashgate.

Huijts, N. M., Molin, E. J., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. Renewable and Sustainable Energy Reviews, 16(1), 525-531.

Huijts, N.M.A., E.J.E. Molin, and B. van Wee (2014), Hydrogen fuel station acceptance: a structural equation model based on the technology acceptance framework, Journal of Environmental Psychology, 38, 153-166.

Hu, P.J., Chau, P.Y.K., Liu Sheng, O.R. & Kar, Y.T. (1999) "Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology", Journal of Management Information Systems, vol. 16, no. 2, pp. 91-112.

Hunt, S. D., Sparkman, R. D., & Wilcox, J. B. (1982). Pretest in survey research: Issues and preliminary findings. Journal of Marketing Research, 19(2), 269-273.

IEA (2009a), *Energy Balances of Non-OECD Countries: 2009 Edition*, Paris, OECD/IEA

IEA (2010), "Sustainable Production of Second-Generation Biofuels. Potential and Perspectives in Major Economies and Developing Countries", OECD/IEA, Paris.

IEA (2015), World Energy Outlook 2006, OECD/IEA, Paris

Israel, G. D. (1992). Determining sample size. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.

IPCC 2001, Climate Change 2001. Houghton, J., Ding, Y., Griggs, D. J., Noguer, M., van der Linden, P. J., Dai, X., ... & Johnson, C. A. (2001). *The Climate change Contribution of Working Group I to the Third Assessment Report of the Intergovemmental Panel on Climate Change*, *159*.

IPCC, 2005, Metz, B., Davidson, O., De Coninck, H. C., Loos, M., & Meyer, L. A. (2005). IPCC special report on carbon dioxide capture and storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA, 442.

IPCC (Intergovernmental Panel on Climate Change), 2007. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change – Climate Change 2007: Mitigation of Climate Change, IPCC Secretariat, Geneva.

IPCC, 2013, Stocker, T. F., Qin, D., Plattner, G. K., Tignor, M., Allen, S. K., Boschung, J., & Midgley, B. M. (2013). IPCC, 2013: climate change 2013: the physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change.

IPCC (Intergovernmental Panel on Climate Change), 2014. Summary for policy-makers. In: Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E. S., Levy, A.N., MacCracken, S., Mastrandrea, P.R., White, L.L. (Eds.), Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sec-toral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom; New York, NY, USA, pp. 1–32.

Islam, M. R. Saidur, R, Rahim, N. A., & Solangi, K. H. (2009). Renewable Energy Research In Malaysia, Engineering e-Transaction, 4(2), 69-72.

Jaafar, M. Z., Kheng, W. H., & Kamaruddin, N. (2003). Greener energy solutions for a sustainable future: issues and challenges for Malaysia. Energy policy, 31(11), 1061-1072.

Jackman, S. (2009) Australians, Americans and Climate Change. United States Studies Centre at the University of Sydney Survey Brief.

Jacobsson, S., & Johnson, A. (2000). The diffusion of renewable energy technology: an analytical framework and key issues for research. Energy policy, 28(9), 625-640.

Jamaludin, A. F. (2009). Energy mix and alternative energy for sustainable development in Malaysia.Universiti Putra Malaysia.

Janes, J. (1999). Survey construction. Library Hi Tech, 17(3), 321-325.

Jarach, M. (1989). An overview of the literature on barriers to the diffusion of renewable energy sources in agriculture. Applied energy, 32(2), 117-131.

Jöreskog, K., & Sörbom, D. (1981). LISERL V: Analysis of Linear Structural Relationships by the Method of maximum Likelihood. Chicago: National Education Resources.

Joreskog, K. G. and Sorbom, D. (1988), A Guide to the Program and Applications.

Kamarudin, A. B., Fazli, M., Sam, M., Md Nor Hayati, T., Ismi, R., & Norhana, M. (2011). Green technology compliance in Malaysia for sustainable business development. Journal of Global Management, 2(1), 55-65.

Kardooni, R., Yusoff, S. B., & Kari, F. B. (2016). Renewable energy technology acceptance in Peninsular Malaysia. Energy Policy, 88, 1-10.

Kardooni, R., Fatimah, K., Siti Rohani, Y., & Siti Hajar, Y. (2014). Traditional knowledge of orang asli on forests in peninsular Malaysia. Ind J Trad Know, 13(2), 283-291.

Kamarudin, A. B., Fazli, M., Sam, M., Md Nor Hayati, T., Ismi, R., & Norhana, M. (2011). Green technology compliance in Malaysia for sustainable business development. Journal of Global Management, 2(1), 55-65.

Keong, C. Y. (2005). Energy demand, economic growth, and energy efficiency—the Bakun dam-induced sustainable energy policy revisited. Energy policy, 33(5), 679-689.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30, 607-610

KeTTHA, MoE, Green Technology and Water, Malaysia (2011), Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) KeTTHA.

Kim, W. G., Lee, Y. K., & Yoo, Y. J. (2006). Predictors of relationship quality and relationship outcomes in luxury restaurants. Journal of Hospitality & Tourism Research, 30(2), 143-169.

Kinnear, T. a., & Talylor, J. (1996). Marketing Research :An Applied Approach. New York: McGraw Hill.

Voget-Kleschin, L. (2012). Sustainability and Equity: A Better Future for All.

Kline, R. B. (2015). Principles and practice of structural equation modeling. Guilford publications.

Kline, R. B. (2005). Principles and Practice of Structural Equation Modelling. NewYork: The Guilford Press.

Kline, R. B. (2005). Principles and Practice of Structural Equation Modelling. New York: The Guilford Press.

Klugman, J.(2011). Sustainability and Equity: A Better Future for All. Human Development Report. UNDP, New York, USA.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. Environmental education research, 8(3), 239-260.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and psychological measurement, 30(3), 607-610.

Krimi, M. S., Yusop, Z., & Hook, L. S. (2010). Regional development disparities in Malaysia. Journal of American Science, 6(3), 70-78.

Krosnick JA, Holbrook AL, Lowe L, Visser PS (2006) The origins and consequences of democratic citizens' policy agendas: a study of popular concern about global warming. Clim Change. doi:10.1007/s10584-006-9068-S

Kuhn. T. (1996). The structure of scientific revolutions (3rd ed.). Chicago: University of Chicago Press.

Lau, L. C., K. T. Tan, K. T. Lee, and A. R. Mohamed. (2009). A comparative study on the energy policies in Japan and Malaysia in fulfilling their nations' obligations towards the Kyoto Protocol: Energy Policy, v. 37, p. 4771-4778.

Lee, Y.H., Ng, H.C., Phua, Y.M. & Nanyang Business School. (2001) Factors affecting the adoption of Electronic Commerce by businesses in Singapore, Nanyang Business School Nanyang Technological University, Singapore.

Leiserowitz A (2003) American Opinions of Global Warming. University of Oregon Survey Research Laboratory, osrl.uoregon.edu/projects/globalwarm

Loewenstein, G., & Lerner, J. S. (2003). The role of affect in decision making. Handbook of affective science, 619(642), 3.

Leiserowitz, A. (2006) Climate change risk perception and policy preferences: The role of affect, imagery, and values. Climatic Change, 77, 45-72.

Leiserowitz, A., Maibach, E. W., Roser-Renouf, C., Feinberg, G., & Howe, P. (2013). Climate Change in the American Mind: Americans' Global Warming Beliefs and Attitudes in April 2013.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (2015). Climate change in the American mind: October, 2015. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication

Liang, T. P., & Yeh, Y. H. (2008, December). Situational effects on the usage intention of mobile games. In Workshop on E-Business (pp. 51-59). Springer Berlin Heidelberg. Liang, T.P., Yi-Hsuan, Y., 2009.

Lidula, N.W.A., Mithulananthan, W., Ongsakul, C., Widjaya, Henson. (2007). ASEAN towards clean and sustainable energy: potentials, utilization and barriers. Renewable Energy 32, 1441–1452.

Lim, X. L., & Lam, W. H. (2014). Public acceptance of marine renewable energy in Malaysia. Energy Policy, 65, 16-26

Lorenzoni, I. and Pidgeon, N.F. (2006). Public views on climate change: European and USAperspectives. Climatic Change, 77, 73-95.

Low Carbon Green Growth Roadmap for Asia and the Pacific,.(2010.p.9)

Lorenzoni, I. and Pidgeon, N.F. (2006). Public views on climate change: European and USA perspectives. Climatic Change, 77, 73-95.

Lucas, H. C., & Spitler, V. K. (1999). Technology use and performance: A field study of Broker Workstations*. Decision sciences, 30(2), 291-311.

Malaysia Energy Information Hub, (2015). ⟨http://meih.st.gov.my/statistics⟩. (Accessed 18.09.15).

Malhotra, N.K. (1993) Marketing Research - An Applied Orientation. Prentice Hall International: New Jersey.

Malhotra, N. K., Agarwal, J., & Peterson, M. (1996). Methodological issues in cross-culture marketing research: A state-of-the-art review. International Marketing Review, 13(5), 7-43.

Marsh, K.L., Wallace, H.M. (2005) the influence of attitudes on beliefs: formation and change. The handbook of attitudes eds Albarracin, D., Johnson, B.T., Zanna, M.P. Lawrence Erlbaum Associates Publishers, London

Martinot, E. (1999). Renewable energy in Russia: markets, development and technology transfer. Renewable and Sustainable Energy Reviews, 3(1), 49-75.

Mathews, J.H. (2000) Responses of Senior Managers to Externally Imposed Change: A Study of Senior Executives in the Queensland Public Sector. Unpublished PhD Thesis, Queensland University of Technology, Brisbane.

Mathieson, K. (1991) "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior", Information Systems Research, vol. 2, no. 3 (September), pp. 173-191.

Maulud, A.L., Saidi, H. (2012). The Malaysian fifth fuel policy: re-strategising the Malaysian renewable energy initiatives. Energy Policy 48, 88–92.

Maxwell, J. A. (2005). Qualitative research design: An interactive approach: Sage Publications, Inc.

Maxwell, S. E., Kelley, K., & Rausch, J. R. (2008). Sample size planning for statistical power and accuracy in parameter estimation. Annu. Rev. Psychol., 59, 537-563.

McCormick, K., & Kåberger, T. (2007). Key barriers for bioenergy in Europe: economic conditions, know-how and institutional capacity, and supply chain co-ordination. Biomass and Bioenergy, 31(7), 443-452.

McDonald, R.P. and Ho, M.-H.R. (2002), "Principles and Practice in Reporting Statistical Equation Analyses,"

Mekhilef S (2010) Renewable energy resources and technologies practice in Malaysia. In: 5th international symposium on hydrocarbons & chemistry (ISHC5), Sidi Fredj, Algiers, 23–25 May 2010, pp 1–9

Mekhilef, S., Barimani, M., Safari, A., & Salam, Z. (2014). Malaysia's renewable energy policies and programs with green aspects. Renewable and Sustainable Energy Reviews, 40, 497-504

Mekhilef S, Safari A, Mustaffa WES, Saidur R, Omar R, Younis MAA .(2012). Solar energy in Malaysia: current state and prospects. Renew Sustain Energ Rev 16:386–396

Miaoulis, George, and R. D. Michener. (1976). An Introduction to Sampling. Dubuque, Iowa: Kendall/Hunt Publishing Company.

Midden, C. J., & Huijts, N. (2009). The role of trust in the affective evaluation of novel risks: The case of CO2 storage. Risk analysis, 29(5), 743-751

Miles, M. B., and Huberman, A. M. (1984), Qualitative data analysis: a source book of new methods, Sage Publications, London.

Miles, J. and Shevlin, M. (2007), "A time and a place for incremental fit indices," Personality and Individual Differences, 42 (5), 869-74.

Molin, E. (2005). Causal analysis of hydrogen acceptance. Transportation Research Record: Journal of the Transportation Research Board, (1941), 115-121.

Molin, E. (2005). Causal analysis of hydrogen acceptance. Transportation Research Record: Journal of the Transportation Research Board, (1941), 115-121.

Molin E, Aouden F, Van Wee B. Car drivers' stated choices for hydrogen cars: evidence from a small-scale experiment. In: Transportation Research Board, 86th Annual Meeting. 2007.

Molin, E., Aouden, F., van Wee, B. (2007). Car drivers' stated choices for hydrogen cars: evidence from a small-scale) experiment. In: 86th Annual Meeting on Transportation Research Board.

Montijn-Dorgelo, F. N., & Midden, C. J. (2008). The role of negative associations and trust in risk perception of new hydrogen systems. Journal of risk research, 11(5), 659-671.

Moon, J.W. & Kim, Y.G. (2001), "Extending the TAM for a World-Wide-Web context", Information & Management, vol. 38, no. 4, pp. 217-230.

MORI Social Research Institute for Regen South West (2003) Public Attitudes Towards Renewable Energy in the South West. http://www.regensw.co.uk/content- download/REPORT-MORIPublicAttitudes.pdf (July 8, 2015)

Moore, G. C. and Benbasat, L. (1991), "Development of an instrument to measure the perceptions of adopting an information technology innovation", Information Systems Research, 2(3): 192-222

Moser, S.C. (2006). Talk of the city: engaging urbanites on climate change. Environ.Res. Lett. 1, 1e10.

Muhammad-Sukki, F., Ramirez-Iniguez, R., Abu-Bakar, S.H., McMeekin, S.G., Stewart, B.G. (2011). An evaluation of the installation of solar photovoltaic in re- sidential houses in Malaysia: Past, present, and future. Energy Policy 39, 7975–7987. 2011. An evaluation of the installation of solar photovoltaic in re- sidential houses in Malaysia: Past, present, and future. Energy Policy 39, 7975–7987.

Mustapa, S. I., Peng, L. Y., & Hashim, A. H. (2010). Issues and challenges of renewable energy development: A Malaysian experience.

NCSE (2000). National Council for Science and the Environment Report on the First National Conference on Science, Policy and the Environment: Recommendations for Improving the Scientific Basis for Environmental Decision-making. December 2000.

NEB (National Energy Balance), 2008. National Energy Balance. Ministry of Energy, Water and Green Technology, Putrajaya, Malaysia.

NEB (National Energy Balance), (2010). National Energy Balance. Ministry of Energy

NEDO (New Energy and Industrial Technology Development Organization). (2004). Infrastructure Improvement Project for Rationalization of International Energy Use (Survey Project on Best Practices of Energy Conservation for Building in South-East Asian Countries). Available at: http://www.eccj.or.jp/cooperation/2-1-2/2004/14.pdf

NST Online, Press. National Green Technology Policy launch today; 24 July.(2009)

Nunnally, J. (1978), Psychometric theory, New York: McGraw-Hill.

OCED, (2010). Reducing Transport Greenhouse Gas Emissions: Trends & Data. This document was produced as background for the 2010 International Transport Forum, on 26 -28 May in Leipzig, Germany, on Transport and Innovation: Unleashing the Potential10].

OECD. (2013). Environmental and Social Statistics. *France: OECD Publication Service*.

O'Garra, T., Mourato, S., Pearson, P. (2008) Investigating attitudes to hydrogen refuelling facilities and the social cost to local residents. Energy Policy 36, 2074-2085.

Oh, Tick Hui, Shen Yee Pang, and Shing Chyi Chua.(2010). "Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth.”Renewable and Sustainable Energy Reviews 14.4, 1241-1252.

Ohunakin, O. S., Adaramola, M. S., Oyewola, O. M., & Fagbenle, R. O. (2014). Solar energy applications and development in Nigeria: drivers and barriers. Renewable and Sustainable Energy Reviews, 32, 294-301.

Olinsky, A., Chen, S. & Harlow, L. (2003), "The comparative efficacy of imputation methods for missing data in structural equation modeling", European Journal of Operational Research, vol. 151, no. 1, pp. 53-79.

Oliver, M., & Jackson, T. (1999). The market for solar photovoltaics. Energy Policy, 27(7), 371-385.

Ölz,S.,Beerepoot,M.(2010).DeployingrenewablesinSoutheastAsia:Trendsand potentials.OECD, Publishing,U.K.. Öl

Ong, H. C., Mahlia, T. M. I., & Masjuki, H. H. (2011). A review on energy scenario and sustainable energy in Malaysia. Renewable and Sustainable Energy Reviews, 15(1), 639-647

Othman, M. R., Martunus, R. Zakaria, and W. J. N. Fernando. (2009). Strategic planning on carbon capture from coal fired plants in Malaysia and Indonesia: A review: Energy Policy, v. 37, p. 1718-1735.

Owen, A. D. (2006). Renewable energy: Externality costs as market barriers.Energy policy, 34(5), 632-642.

Quadir, S. A., Mathur, S. S., & Kandpal, T. C. (1995). Barriers to dissemination of renewable energy technologies for cooking. Energy conversion and management, 36(12), 1129-1132.

Painuly, J. P. (2001). Barriers to renewable energy penetration; a framework for analysis. Renewable energy, 24(1), 73-89.

Patchen, M., (2006). Public Attitudes and Behavior about Climate Change: What Shapes Them and How to Influence Them. University of Purdue, East Lafayette, Indiana.

Punch, K. F. (2003). Survey Research: The Basics. London: Sage Publications Ltd.

Payne, J.W., Bettman, J.R., Johnson, E.J. (1993) The adaptive decision maker. Cambridge University Press, New York.

Petinrin, J. O., & Shaaban, M. (2015). Renewable energy for continuous energy sustainability in Malaysia. Renewable and Sustainable Energy Reviews, 50, 967-981

Pew research center, November (2015). “Global concern about climate change, Broad support for limiting emission” by Bruce Stokes, Richard Wike and Jill Carle

Pohekar, S. D., Kumar, D., & Ramachandran, M. (2005). Dissemination of cooking energy alternatives in India—a review. Renewable and Sustainable Energy Reviews, 9(4), 379-393.

Pokharel, S. (2003). Promotional issues on alternative energy technologies in Nepal. Energy Policy, 31(4), 307-318.

Poortinga W., Pidgeon, N.F. and Lorenzoni, I. (2006). Public Perceptions of Nuclear Power, Climate Change and Energy Options in Britain: Summary Findings of a Survey Conducted during October and November 2005. Technical Report (Understanding Risk Working Paper 06-02). Norwich: Centre for Environmental Risk.

Poortinga, W., Aoyagi, M., & Pidgeon, N. F. (2013). Public perceptions of climate change and energy futures before and after the Fukushima accident: A comparison between Britain and Japan. Energy Policy, 62, 1204-1211.

Popper, K. R. (1959), the logic of scientific discovery. New York: Routledge

Preacher, K. J. (2006). Quantifying parsimony in structural equation modeling. Multivariate Behavioral Research, 41(3), 227-259.

Punch, K. F. (1998). Introduction to Social Research: Quantitative and Qualitative Approaches. London: Sage

Rahim, K. A., and A. Liwan. (2012). Oil and gas trends and implications in Malaysia: Energy Policy, v. 50, p. 262-271.

Rahman Mohamed, A., & Lee, K. T.(2006). Energy for sustainable development in Malaysia: Energy policy and alternative energy. Energy Policy, 34(15), 2388-2397.

Raykov, T. (2000). On sensitivity of structural equation modeling to latent relationship misspecification. Structural Equation Modeling, 7, 596–607.

Raykov, T. (2004). Behavioral scale and measurement invariance evaluation via latent variable modeling. Behavior Therapy, 33, 299–331.REN 21

Ribeiro, F., Ferreira, P., Araújo, M., & Braga, A. C. (2014). Public opinion on renewable energy technologies in Portugal. Energy, 69, 39-50.

Rijal, K. (1999). Renewable energy policy options for mountain communities: experiences from China, India, Nepal and Pakistan. Renewable energy,16(1), 1138-1142.

Ross, A. (2009). Modern interpretations of sustainable development. Journal of Law and Society, 36(1), 32-54.

Rowley, J. (2002). 'Using case studies in research', Management Research News, vol. 25, no. 1, pp. 16-27.

Ruble, I., & El Khoury, P. (2013). Lebanon's market for domestic solar water heaters: Achievements and barriers. Energy for Sustainable Development,17(1), 54-61.

Sabri, M. F., & Teoh, Y. Y. (2006). Tahap keprihatinan alam sekitar dan amalan kepenggunaan hijau pengguna di Petaling Jaya, Selangor. Pertanika Journal of Social Sciences & Humanities, 14(2), 95-109.

Sterman, J. D., & Sweeney, L. B. (2007). Understanding public complacency about climate change: Adults' mental models of climate change violate conservation of matter. Climatic Change, 80(3-4), 213-238.

Saidur, R., Islam, M.R., Rahim, N.A. and Solangi, K.H. (2010). A review on global wind energy policy

Salciuviene, L., Auruskeviciene, & Lydeka, Z. (2005). An assessment of various approaches for cross-cultural consumer research. Problems and Perspectives in Management, 3, 147-159

Sandu ICA, de Sa MH, Costa Pereira M. (2011). Ancient "gilded" artobjects from the European cultural heritage: A review on different scales of characterization. Surface Interface Analysis, Special Issue dedicated to Cultural Heritage, 43, 2011 (DOI 10.1002/sia.3740).

Safaai, N. S. M., Noor, Z. Z., Hashim, H., Ujang, Z., & Talib, J. (2011). Projection of CO2 emissions in Malaysia. Environmental Progress & Sustainable Energy, 30(4), 658-665.

Sarkar, M. S. K., Begum, R. A., Pereira, J. J., & Jaafar, A. H.(2013).Trends of Energy Demand and Supply as well as GHG Emissions in Malaysia. Energy, 147, 66.

Sayigh, A.(1999). Renewable Energy-The way Forward. Applied Energy Vol.64. pp1530

Schultz, R. L., & Slevin, D. P. (1975). A program for research in implementation, in Schultz, R. L. and Slevin, D. P. (eds.), Implementing Operations Research/Management Science, New York: American Elsevier

Sekaran, U. (2000). Research Methods for Business: A Skill -Building Approach (3ed ed.). New York: John Wiley & Sons, Inc.

Sekaran, U. (2000), Research Methods for Business: A Skill Building Approach, John Wiley and Sons.

Seng, L. Y., Lalchand, G., & Lin, G. M. S. (2008). Economical, environmental and technical analysis of building integrated photovoltaic systems in Malaysia. Energy Policy, 36(6), 2130-2142.

Shekarchian, M., Moghavvemi, M., Mahlia, T. M. I., & Mazandarani, A. (2011). A review on the pattern of electricity generation and emission in Malaysia from 1976 to 2008. Renewable and Sustainable Energy Reviews, 15(6), 2629-2642.

Shuit, S. H., Tan, K. T., Lee, K. T., & Kamaruddin, A. H. (2009). Oil palm biomass as a sustainable energy source: a Malaysian case study. Energy, 34(9), 1225-1235.

Siegrist, M., Cvetkovich, G. (2000) Perception of hazards: the role of social trust and knowledge. Risk analysis 20, 713-719.

Sovacool, Benjamin K., and Ira Martina Drupady.(2011). Examining the Small Renewable Energy Power (SREP) Program in Malaysia. Energy Policy 39.11 (2011): 7244-7256.

Sovacool, B. K., & Drupady, I. M. (2011). Examining the small renewable energy power (SREP) program in Malaysia. Energy Policy, 39(11), 7244-7256.

Spence, A. and Pidgeon, N.F. (2009). Psychology, climate change and sustainable behaviour. Environment, 51(6), 8-18.

Sriram, S. (2006). Malaysian Renewable Energy

Stamm, K. R., Clark, F. & Eblacas, P. R. (2000). Mass communication and public understanding of environmental problems: the case of global warming. Public Understanding of Science, 9: 219-237.

Stambouli, A. B., & Traversa, E. (2002). Fuel cells, an alternative to standard sources of energy. Renewable and Sustainable Energy Reviews,6(3), 295-304

Sterman, J. D., & Sweeney, L. B. (2007). Understanding public complacency about climate change: Adults' mental models of climate change violate conservation of matter. Climatic Change, 80(3-4), 213-238

Steg, L., & Groot, J. (2010). Explaining prosocial intentions: Testing causal relationships in the norm activation model. British journal of social psychology, 49(4), 725-743. Steg L, de Groot J.

Strauss, A., & Corbin, J. (1990). Basics of qualitative research (Vol. 15). Newbury Park, CA: Sage.

Sumathi, S., Chai, S.P. & Mohamed, A.R. (2008). Utilization of oil palm as a source of renewable energy in Malaysia. Renewable and Sustainable Energy Reviews, 12,2404-2420

Sumiani Yusoff (1997). The development of environmental engineering education in Malaysia. Journal of Japanese Society for Engineering Education, 44 (6).

Tabachnick, B. G., & Fidell, L. S. (2001). Using Multivariate Statistics (4th ed.). Boston: Allyn and Bacon

Tabachnick, B. & Fidell, L. (2001), "Using multivariate statistics", Boston: Allyn and Bacon.

Tanggapan, D., Geetha, C., Mohidin, R., & Vincent, V. (2011). The relationship between economic growth and foreign direct investment in Malaysia: analysis based on location advantage theory. Management, 1(2), 24-31.

Taylor, S., and Todd, P. A. (1995), "Understanding information technology usage: A test of competing models", Information Systems Research, 6: 144-176.

Teddlie, C. & Yu, F. (2007) "Mixed methods sampling", Journal of Mixed Methods Research, vol. 1, no. 1, pp. 77.

Temple, B. (1997). "Watch your tongue": Issues in translation and cross-cultural research. Sociology, 31(3), 607-618.

Teo, T., & Noyes, J. (2011). An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: A structural equation modeling approach. Computers & Education, 57(2), 1645-1653.

Thompson, S. K. (1990). Adaptive cluster sampling. Journal of the American Statistical Association, 85(412), 1050-1059.

Thompson, B. (1997). The importance of structure coefficient in structural equation modeling confirmatory factor analysis. Educational and Psychological Measurement, 57(1), 5-19.

Toft, M. B., Schuitema, G., & Thøgersen, J. (2014). Responsible technology acceptance: Model development and application to consumer acceptance of Smart Grid technology. Applied Energy, 134, 392-400.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. Engineering Management, IEEE Transactions on, (1), 28-45.

Tsantopoulos, G., Arabatzis, G., & Tampakis, S. (2014). Public attitudes towards photovoltaic developments: case study from Greece. Energy Policy, 71, 94-106.

T. Syed Jalal & Pat Bodger, (2009). National Energy Policies and the Electricity Sector in Malaysia

Turner, M., Kitchenham, B., Brereton, P., Charters, S., & Budgen, D. (2010). Does the technology acceptance model predict actual use? A systematic literature review. Information and Software Technology, 52(5), 463-479.

Turner, M., Kitchenham, B., Brereton, P., Charters, S., & Budgen, D. (2010). Does the technology acceptance model predict actual use? A systematic literature review. Information and Software Technology, 52(5), 463-479.

Umar, M. S., Jennings, P., & Urmee, T. (2014). Generating renewable energy from oil palm biomass in Malaysia: The Feed-in Tariff policy framework. Biomass and Bioenergy, 62, 37-46

UNDP Human Development Report 2011, 2012

UNEP (2012). Green Economy Policy Briefs – key issues for the transformation towards the Green Economy, UNEP

Venkatesh, V., Davis, F.D., (2000), "Theoretical extension of the technology acceptance model: four longitudinal field studies", Management Science, Vol. 46(2): 186-204.

Von Borgstede, C., Andersson, M., & Johnsson, F. (2013). Public attitudes to climate change and carbon mitigation—Implications for energy-associated behaviours. Energy Policy, 57, 182-193.

Wheaton, B., Muthen, B., Alwin, D. F., & summer, G. F. (1977). Assessing reliability and stability in panel models. In D. R. Heise (Ed.), Sociological Methodology (pp. 84-136). San Francisco: Jossy-Bass.

Wilkins, G. (2010). Technology transfer for renewable energy. Taylor & Francis.

Wilson, K. (2004). Drought, debate, and uncertainty: measuring reporters' knowledge and ignorance about climate change, Public Understanding of Science, 9: 1-13.

Wong X, Yen DC, Fang X (2004). E-commerce development in China and its implications for business. Asia Pac, J. Mark. Logistics, 16(3): 68-83.

World Resources Institute – Climate Analysis Indicator Tools ([WRI CAIT)] and the World Bank)

Yeh, K.-J. (2009). Reconceptualizing Technology Use and Information System Success: Developing and Testing a Theoretically Integrated Model

Yi, M.Y. & Hwang, Y. (2003) "Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model", International Journal of Human-Computer Studies, vol. 59, no. 4, pp. 431-449.

Yi, M.Y. & Hwang, Y. (2003) "Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model", International Journal of Human-Computer Studies, vol. 59, no. 4, pp. 431-449.

Yin, R. (1994). Case study research: Design and methods. Beverly Hills.

Yusoff, S. (2003). The need for emphasis on environmental education for national development in Malaysia. Masalah Pendidikan, 26, 75-82.

Zaiţ, A., & BERTEA, P. S. P. E. (2011). Methods for testing discriminant validity. Management & Marketing Journal, 9(2). P.217

Jaafar, M. Z., Kheng, W. H., & Kamaruddin, N. (2003). Greener energy solutions for a sustainable future: issues and challenges for Malaysia. Energy policy, 31(11), 1061-1072.

Zikmund, W. G. (2003). Exploring Marketing Research. Cincinnati, Ohio: Thomson/South-Western

Zulkifli, D. A., & Aslam, M. M. (2015). Public acceptance of renewable energy in Malaysia: a NIMBY approach. Australian Journal of Basic and Applied Sciences, 9(8 Special), 74-81

Zikmund, W.G. (2000), Business Research Methods, 6th ed., the Dryden Press, Chicago, IL

De vaus, D.A.(1991), surveys in Social Research, London, Allen &Unwin, 1991, 3rd edn. ahanlu, Shahab (2010), Step by step guide on health and medical research,Tehran, Darya, First Edition.

Midden, C. J., & Huijts, N. (2009). The role of trust in the affective evaluation of novel risks: The case of CO2 storage. Risk analysis, 29(5), 743-751.

APPENDIX A: QUESTIONNAIRE CLIMATE

Section I. Global Climate Change, *Perubahan Iklim*

Please tick (✓) ONE only, *Sila tanda (✓) SATU sahaja*

No	Statement *Pamyataan*	Yes *Ya*	No *Tidak*
1	1. Are you conscious about the environment? *Adakah anda prihatin terhadap alam sekitar*		
2	2. Have you heard of global warming? *Adakah anda pernah mendengar tantang pemanasan global?*		
3	3. Are you aware of climate change accepted nowadays? *Adakah anda sedar akan perubahan iklim yang beriaku pada masa kini?*		
4	4. In your opinion, is the current climate change only happen in Malaysia? *Pada pandangan anda, adakah perubahan iklim yang beriaku kini hanya beriaku di Malaysia?*		
5	5. How concerned are you about climate change?		

To what extent do you aware with the following statements about the consciousness toward the environment (state number 1-5 according to the scale below):
Sejauh manakah kesedaran anda dengan pemyataan berkenaan keprihatinan terhadap alam sekitar berikut?(Tuliskan nombor 1-5 mengikut skala di bawah):

No	Statement	1. Very unaware *Sangat tidak sedar*	2. not unaware *t tidak sedar*	3. Moderately aware *Sederhana sedar sedar*	4. Awar e Sedar	5. very aware *Sangat sedar*
	I find the following climate change is now taking place in Malaysia: *Saya dapati perubahan iklim berikut kini beriaku di Malaysia:*					
	a. The weather has become warmer/unpredictable Cuaca semakin panas/tidak menentu					
	b. rain has become more frequent Bencana benjir semakin karap					
	c. Flash floods occur more frequently encana banjir semakin kerap					
	d. An increase in greenhouse gases (GHG) that contributes to global warming peningkatan gas rumah hujau yang menyumbang kepada masalah pemanasan global					

5	I find the following are the main reasons for climate change: *Saya dapti fraktor berikut merupakan factor utama yang menybebkan masalah perubahan iklim:*					
	a. The excessive use of natural resources (such as water, air, land and funa) penggunaan sumber alam yang beriebihan (seperti air, udara, tanah, flora dan fauna)					
	b. Excessive burning of fossil fuel Pembakaran bahan api fosil yand beriebihan					
	c. unmanaged released of hazardous fumes form factories/open burning pembebasan asap berbbahaya loeh kilang yand tidak terurus /pembakaran terbuka					
	d. Excessive consumption and production of products by human beings penggunaan dan pengeluaran produk yang berlebihan oleh mansuia					
	e. The excessive use of electricity penggunaan electric yang tidak berhemah /berlebihan					
	f. the increase in the number of vehicles and emissions on the road Bilangan Kendaraan dan pengeluaran asap kenderaan yand semakin meningkat					
	Climate change mostly caused by natural process.					
6	I find renewable energy products have a positive impact on environment					
7	I find that the religious implemented by the government to protect the environment should be increased *Saya dapati undangg undang yang dilaksanakan oleh kerajaan untuk melindungi alam sekitar perlu ditingkatkan*					
8	I find the level of consciousness and knowledge amongst Malaysians regarding environmental care should be increased *Saya depati keprihatinan dan pengetahuan rakyat Malaysia dalam menjaga alam sekitar perlu ditingkatkar*					
9	I find the need for a clear channel for making complaints about environmental pollution *Saya dapati perlunya saluran yand jelas untuk membuat aduan berkenaan pencemaran alam sekitar*					
10	I find that pollution badly affects the flora and funa *Saya dapati pencemaran emberikan kesan buruk kepada flora dan funa*					

11	I find that the manufacturing industry concerns in protecting the environment should be increased *Saya dapati keprihatinan industry perkilangan dala menaga alam sekitar perlu ditingkatkan*					
12	I find the environmental education should be incorporated form primary school level *Saya dapati pendidikan alam sekitar perlu diterapkan dari peringkat sekolah rendah*					

Section ii. Green technology, *Teknologi hijau*

Please tick (✓) ONE only, *Sila tanda (✓) SATU sahaja*

No	Statement *Pamyataan*	Yes *Ya*	No *Tidak*
1	Have you ever heard of GREEN TECHNOLOGY? *Permahkah ANDA menengar tentang TEKNOLOGHI HIJAU?*		
2	Do you know about the green technology initiative promoted by the government? *Adakah anda mengetahul tentang inisiatif teknologi hijau yang kini dijalankan oleh kerajaan?*		

To what extend to you aware with the following statements about GREEN TECHNOLOGY? (Please arrange 1-5 according to the scale below):
Sejauh manakah kesedaran anda dengan pemyataan berkenaan dengan TEKNOLOGI HIJAU? (Tuliskan nombor 1-5 mengikut skala di bawah)

No	Statement	1. Very unaware *Sangat tidak sedar*	2. not unaware *t tidak sedar*	3. Moderately aware *Sederhana sedar sedar*	4. Aware Sedar	5. very aware *Sangat sedar*
3	I'm aware the following are the concepts of green technology Saya tahu/sedar konsep teknologi hijau adalah seperti berikut.					
	a. Development and application of products, equipments, and systems used to conserve the natural environment and resources which minimize and reduces the negative impact of human activity pembangunan dan pengaplikasian produk, peralatan dan system untuk memlihara alam sekitar dan sumber alam yang dapat meminimakan dan mengurangkan impak negative hasil daripada aktiviti manusia.					
	b. Minimizes degradation to the environment *Meminimimakan degradasi terhadap alam sekitar*					
	c. has zero or low greenhouse gas emission					

	Mempunyai peelepassan gas rumah hiju yang rendah atau sifar					
	d. safe for used and promote healthy and improved environment for all forms of lives *selamat untuk digunakan dan meningkatkan kualiti alam sekitar untuk kehidupan sihat bagi semua makhuluk*					
	e. conserve use of energy and natural resources *pemeliharaan tenaga dan sumber alam sekitar*					
	f. promotes the used of renewable resources *Menggalakkan penggunaan tenaga boleh diperbaharui*					
4	I find green technology applications can be done by the public at home (such as using public transport, energy saving home renovations, water conservation and recycling practies) *Saya dapati aplikasi teknologi hijau boleh dilakukan oleh orang awam di rumah (seperti penggunaan pengangkutan awam, ubah sual rumah jimat tenaga, penjimatan air dan amalan kitar semula)*					
5	I find the continuous use of green technology will sate the earth *Saya dapati penggunaan teknologi hijau secara berterusan dapat membantu menyelamatkan bumi*					
6	If you think the continuous use of green technology does not help save the earth, please state your reason. Jika and berpendapat penggunaan teknologi huiau seara berterusan tidak dapat membantu menyelamtkan buml, sila nyatakan alas an anda.					
7	Have YOU ever heard about GREEN PRODUCT? Pemakhak ANDA mendengar berkenaan PRODUK HIJAU?					
8	Have YOU used green product before? Pemahkah ANDA menggunakan produk hijau?					

Please tick (✓) ONE only, *Sila tanda (✓) SATU sahaja :*

No	Statement *Pamyataan*	Yes *Ya*	No *Tidak*
21	Have you heard of the concept of renewable energy? Pemahkah anda mendengarkonsep tenaga boleh diperbaharui?		
22	To your knowledge, are the following resources can be used as renewable energy sources: *Pada pengetahuan anda , adakah yang berikut merupakan sumber alam yang boleh dijadikan sebagai sumber tenaga boleh diperbaharui?*		
	a. Sun rays/ solar , CAhaya matahari/solar		
	b. Wind , Angin		
	c. Water, Air		
	d. Nuclear, Nuklear		
	e. Biomass , Biomas (Hampas tumbuh-tumbuhan spt kelapa sawit, tebu, dll)		
	f. Geothermal, Geotermal		

No	Statement *Pamyataan*	Yes *Ya*	No *Tidak*
1	Have you heard of the following policies/ programmes initiated by the government *Pemahkah anda mendengar polisi/ program berikut yan dijalankan oleh kerajaan?*		
	ii. policy, Polisi		
	a. Polisi Teknologi Jijau Negara National Gren Technology Policy		
	b. Polisi Tenaga Diperbaharui dan Pelan Tindakan Kebangsaan 2009 National Renewable energy policy and Action Plan 2009		
	c. Akta Tenaga Boleh Diperbaharui 2011 Renewable Energy Act 2011		
	d. Akta Lembaga Pembangunan Tenaga Mapan 2011 Sustainable Energy Development Authority Act 2011		
	e. Pengecualian Cukai Pelaburan (PCP) Investment Tax Allowance (ITA)		
	f. Pelan Induk Tenaga Negara National Energy Master Plan		
	g. Mekanisme Pembangunan Kebersihan Clean Development Mechanism		
	h. Pelan Tindakan inffrastruktur Kenderaan Elektrik Electric vehicle infrastructure Roadmap		
	i. Rangka Kerja Bandar RAya Karbon Rendah Low Carbon City Framework		
	j. Polisi Laluan Hijau bagi SME inovatif Malaysia Green lane Policy for Innovative Malaysian SMEs		
	k. Pelan induk Nasional Pengangkutan Awam Darat National Land Public Transport Master Plan		
	ii. Program Programme		
	l. Feed-in-Tariff untuk Tenaga Boleh Diperhaharui Feed-in-Trariff for Renewable Energy		
	m. Bangunan Low Energy Office (LEO) Low Energy Office (LEO) Building		
	n. Indeks Bangunan Hijau (dengan kerjasama sector swasta) Green Building Index (in cooperation with the private sector)		
	o. Skim Pembiayaan Teknologi Hijau (SPTH) Green Technology Financing Scheme (GTFS)		
	p. Program Rebat Penjimatan Save Rebate Programme		
	q. Persidangan dan Perman Teknologi Hijau dan Produk Antarabangsa Malaysia (IGEM)		

	International Green Tech and Eco Products Exhibition and Conference Malaysia (IGEM)		
	r. Perbandaran Hijau Green Township		
	s. Kamival 1Hijau 1komuniti 1 Green 1Community Camival		
	t. perolehan Jijau (Program MyJIJAU) Green Procurement (MyHIJAU Programme)		
2	Based on question 1 above, to your knowledge/opinion do you think the policies/ programmes implemented by the govemment as the above have been successful? *Berdasarkan Soalan 1 di atas , pada pengetahuan/pandangan anda, adakah polisi/pgrogram yang dijalankan oleh kerajaan seperti di atas berjaya?*		

To what extend to you aware with the following statements (please arrange 1-5 according to the scale below

Sejauh manakah kesedaran anda dengan kenyataan berikut? (Tuliskan nombor 1-5 mengikut skala di bawah):

No	Statement	1. Very unaware *Sangat tidak sedar*	2. not unaware *t tidak sedar*	3. Moderately aware *Sederhana sedar sedar*	4. Aware Sedar	5. very aware *Sangat sedar*
3	If not successful, please indicate according to the scale from 1-5 according to the scale above Sekiranya TIDAK berjaya, tuliskan nombor 1-5 mengikut skala mengikut skala di atas keberkesanannya					

Please state, Sila nyatakan:

5	What other advertisements besides the existing ones should be aired in the mass media? Selain daripada ikian sedia ada, apakah jenis ikian lain yang periu disiarkan oleh media massa? …… …… …… ……

To what extend to you aware with the following statements on steps to increase public awareness on environmentally friendly practices and green techno (please arrange 1-5 according to the scale below):

Sejauh manakah kesedaran anda mengenai langkah untuk meningkatkan kesedaran awam terhadap amalan mesra alam dan produk teknologi hijau? (Tukistan nombor 1-5 mengikut skala di bawah):

No	Statement	1. Very unaware *Sangat tidak sedar*	2. not unaware *t tidak sedar*	3. Moderately aware *Sederhana sedar sedar*	4. Aware Sedar	5. very aware *Sangat sedar*
6	Saya dapati kurikulim alam sekitar dan teknologi hijau perlu diperkenalkan di semua peringkat sekolah I find that modules on green technology should be introduced at all school levels					
7	Saya dapati kesedaran orange ramai perlu ditingkatkan melaui program dan kempen yang bersesualan I find that the awareness of public should be increased through suitable programmes and campaigns					
8	Saya dapati kempen alam sekitar dan penggunaan teknologi hijau periu ditingkatkan di media massa dan media social I find that campaign on environment and use of green technology should be increased via the mass media and social media					
9	Saya dapati penguatkuassan undang – undang perlu diketatkan untuk mengawal alam sekitar I find that a more stringent law enforcement is needed to protect the environment					
10	Saya dapati kadar denda/penalty untuk pesalah yang melanggar undang – undang alam sekitar perlu dinaikkan I find that the penalty for flouting environmental laws should be increased					
11	Saya dapati cukai perlu dikenakan kepada individu/industri yang kerap menggunakan produk yand tidak mesra alam I find that taxes should be charged to individuals/industries that frequently use products that are not environmentally – friendly					
12	Saya dapati perlunya factor penarik dan penolak (insentif dan penguatkuasaan undang-undang) dalam menggalakkan penggunaan teknologi hijau I find the need for pull and push (incentives and law) factors in encouraging the usage of green technology					

13	Saya dapati perlunya ada peneraapan nilai yang selaras dengan prinsip keagamaan yand menggalakkan pemuliharaan alam sekitar dan teknologi hujau I find the need to inculcate religious values in environmental conservation and green technology					
14	Saya dapati pengenalan pusat sehenti/agensi untuk menyebarkan maklumat teknologi hijau adalah wajar I find that the introduction of a one stop center / agency to dissemintate information on green technology is appropriate					
15	Saya dapati sumber semulajadi perlu dilindungi dengan aktiviti pemeliharaan dan pemuliharaan I find that natural resources must be protected with conservation and rehabilitation activities					

No	When you think of climate change, what is the first word or phrase that comes to your mind?" Apabila anda fikir tentang perubahan iklim, apakah perkataan atau frasa pertama yang muncul dalamm fikiran anda?
32	☐ Peningkatan gas rumah kaca, an increase in GHG ☐ Banjir kilat lebih kerap berlaku, flash floods ☐ Hujan semakin kerap turun , Rain become more frequently ☐ Iklim semakin panas , weather become warmer

To what extend to you aware with the following statements on steps to increase public awareness on environmentally friendly practices and green techno (please arrange 1-5 according to the scale below):

No	Statement	1. Very unaware *Sangat tidak sedar*	2. not unaware *t tidak sedar*	3. Moderately aware *Sederhana sedar sedar*	4. Aware Sedar	5. very aware *Sangat sedar*
8	I intend to use renewable energy technology as often as necessary. Saya ingin menggunakan teknologi tenaga boleh diperbaharu sekerap mungkin					
9	I intend to continue using renewable energy in the future. Saya ingin terus menggunakan tenaga boleh diperbaharu pada masa hadapan.					

10	Assuming I have access to renewable energy technology, I intend to use it. Sekiranya saya dapat mengakses teknologi tenaga boleh diperbaharu, saya ingin menggunakan teknologi tersebut.					
11	I find the quality of renewable energy products is not as good as ordinary products. Saya dapati kualiti produk tenaga boleh diperbaharu tidak sebaik produk biasa					
12	I will strongly recommend that others use renewable energy technology. Saya benar-benar menyarankan orang lain untuk menggunakan teknologi tenaga boleh diperbaharu.					
13	Renewable energy technology improves the quality of daily life for the public at home. Teknologi tenaga boleh diperbaharu meningkatkan kualiti kehidupan seharian untuk orang ramai di rumah.					
14	Renewable energy technology makes it easier to protect the environment. Teknologi tenaga boleh diperbaharu menjadikan lebih mudah untuk melindungi alam sekitar.					
15	Continuous use of renewable energy technology enables me to reduce my electricity costs. Penggunaan berterusan teknologi tenaga boleh diperbaharu membolehkan saya mengurangkan kos elektrik.					
16	Using renewable energy technology enhances the effectiveness of using energy. Produk tenaga boleh diperbaharu membolehkan saya melindungi kesihatan masyarakat					
17	Learning to operate renewable energy is easy for me. Menggunakan teknologi tenaga boleh diperbaharu meningkatkan keberkesanan penggunaan tenaga.					
18	I find renewable energy technology flexible to interact with. Belajar mengendalikan tenaga boleh diperbaharu adalah mudah bagi saya.					
19	It is easy for me to become skilful at using renewable energy technology. Saya dapati mudah untuk menggunakan teknologi tenaga boleh diperbaharu mengikut kehendak saya.					

20	Overall, I find renewable energy technology easy to use. Saya dapati teknologi tenaga boleh diperbaharu adalah fleksibel untuk digunakan					
21	I find that renewable energy products are more expensive. Mudah bagi saya untuk mahir menggunakan teknologi tenaga boleh diperbaharu.					
22	I find the purchase of renewable energy products a good investment for future generations. Secara keseluruhan, saya dapati teknologi tenaga boleh diperbaharu mudah untuk digunakan.					
23	I find that renewable energy products are more expensive compared with other product brands. Saya dapati produk tenaga boleh diperbaharu adalah lebih mahal.					
24	I think that renewable energy products should be cheaper price to encourage their purchase. Saya dapati pembelian produk tenaga boleh diperbaharu adalah pelaburan yang baik untuk generasi akan datang.					
25	I think that the weather has become warmer in Malaysia. Saya dapati produk tenaga boleh diperbaharu adalah lebih mahal berbanding dengan produk jenama lain					
26	I think that the level of consciousness and knowledge amongst Malaysians regarding climate change should be increased. Saya berpendapat produk tenaga boleh diperbaharu perlu lebih murah untuk menggalakkan pembelian.					
27	Excessive burning of fossil fuel is the main reason for climate change. Saya rasa cuaca di Malaysia semakin panas.					
28	The excessive use of natural resources (such as water and air) is the reason for climate change. Saya berpendapat tahap kesedaran dan pengetahuan dalam kalangan rakyat Malaysia berkenaan penjagaan alam sekitar perlu dipertingkatkan.					
29	RE technology minimizes degradation to the environment.					

	Pembakaran berlebihan bahan api fosil adalah penyebab utama terhadap perubahan iklim.					

No	Overall what is your opinion of Renewable energy?
	☐ Very good idea ☐ Fairly good idea ☐ Very bad idea ☐ Do not know

Answer questions as they relate to you. For most answers, check the box(es) most applicable to you or fill in the blanks.

- 1. Your Gender, Jantina
  - ☐ Female, Perempuan
  - ☐ Male, Lelaki
- 2. Your Age, Umur
  - ☐ 20 years old & below, 20 tahun & ke bawah
  - ☐ 21-25 years old, tahun
  - ☐ 26-30 years old, tahun
  - ☐ 31-35 years old, tahun
  - ☐ 36-40 years old, tahun
  - ☐ 41-45 years old, tahun
  - ☐ 46-50 years old, tahun
  - ☐ 51-55 years old, tahun
  - ☐ 56-60 years old, tahun
  - ☐ 61 years old & older, tahun & & ke atas
- 3. Your Ethnicity, Bangas
  - ☐ Melayu Malay
  - ☐ Cina Chinese
  - ☐ India Indian
  - ☐ Bumiputera Sabah Sabahan
  - ☐ Bumiputera Sarawak Sarawakian
  - ☐ Pribumi Indigenous
  - ☐ Lain-lain Others
- 4. Your Religion, Agama
  - ☐ Islam Islam
  - ☐ Kristian Christian
  - ☐ Buddha Buddhist
  - ☐ Hindu Hindu
  - ☐ Lain-lain Others

- 5. Your Marital Statue, Status Perkahwinan

☐ Bujang single
☐ Berkahwin Married
☐ Bercerai Divorced
☐ Balu Widowler
☐ Ibu/Bapa tunggal single parent

- 6. No. of family members , Bil. Ahli keluarga

……..

- 7. Your Monthly Income, Gaji Bulanan

☐ RM 1000 & ke bawah & below
☐ RM 1001 – RM 2000
☐ RM 2001 – RM 3000
☐ RM 3001 – RM 4000
☐ RM 4001 – RM 5000
☐ RM 5001 & ke atas & above

- 8. Household income, Pendapatan Isi Rumah

☐ RM 1000 & ke bawah & below
☐ RM 1001 – RM 2000
☐ RM 2001 – RM 3000
☐ RM 3001 – RM 4000
☐ RM 4001 – RM 5000
☐ RM 5001 & ke atas & above

- 9. Your Highest level of Education, Tahap Oengajian Tertinggi

☐ Tiada Pendidikan Formal No FormalEducation
☐ Pendidikian Rendah Primary Education
☐ Pendidikian Menengah Secondary Education
☐ STPM HSC
☐ Sijil Certificate
☐ Diploma Diploma
☐ Ijazah Sarjana Muda Bachelor Degree
☐ Ijazah Sarjana Master Degrer
☐ Ijazah Kedoktoran PhD
☐ Lain-Lain others

please state ,Sila nyatakan ……

- 10. Your Occupational Sector, Sektor Pekerjaan

☐ Kerajaan Govemment
☐ Swasta Private
☐ Persendirian Freelance

- 11. Your Main Occupation, Pekerjaan Utama

☐ Pengurusan Managerial
☐ Professional professional
☐ Juruteknik & Pembantu Profesional Technician & Associate Professional
☐ Pembantu Tadbir & Perkeranian Clerical Support Worker
☐ Jualan & Perkhidmatan Sales & Services
☐ Pekerja Mahir Pertanian , Perhutanan & Perikanan Skilled Agricultural , Foresty & Fishery Worker

☐ Pekerja Kraf & Industri yan Berkaitan Craft Worker & related Industries
☐ Pekerja Operasi Loji & mosein Plant and Machine operator & Assembler
☐ Pekerjaan Am General Occupation
☐ Polis/Bomb/Pasukan Beruniform/Bersenjata Police/Fire-fighter/Uniformed /Armed Forces
☐ Pelajar Sekolah Menengah secondary School Student
☐ Pekerja Universiti Tertiary student
☐ Lain-Lain others

please state ,Sila nyatakan ……

APPENDIX B: RESEARCH QUESTIONS FOR SEMI STRUCTURED INTERVIEW

Section I: Personal Information

1- Name:

2- Designation:

3- Work address:

4- Citizenship:

5-

Section II

Perception about RE Situation in Malaysia

Please state your view on the questions below:

1- To what extent do you consider the Five Fuel Strategy in the energy supply mix in Malaysia as appropriate for Malaysia?
2- What do you think is the role of Malaysian context (Local culture, local regulations, human resource specificities,) in preventing the achievement of renewable energy targets in Malaysia?
3- To what extent do you consider the role of knowledge and cost (people's consciousness of the importance of the implementation of the RE) had a hand in RE policy development in Malaysia?
4- To what extent do you consider perceived ease of use and perceived usefulness affect RE acceptance in Malaysia?
5- How much priority does the government has on the need of using renewable energy in Malaysia?
6- How important do you think each of the following is for the success of development of renewable energy policy in Malaysia?

		Very important	Important	not important	Do not know
1	Having abundant renewable energy resources.	O	O	O	O
2	Local culture of country (Malaysia)	O	O	O	O
3	Knowledgability of people about the usefulness of using renewable energy	O	O	O	O

4	The way which government Implement the of policy	O	O	O	O
5	Rule and regulation about involving in renewable energy industry	O	O	O	O
6	Political environment	O	O	O	O
7	Role of organizations that are involve in imply policy	O	O	O	O
8	Role of mess media	O	O	O	O
9	Encourage privet sector for involving in renewable energy market.	O	O	O	O
10	Local regulation	O	O	O	O

7- How important do you think each of the following issue is for implementation of renewable energy in Malaysia?

		Very important	Important	Do not important	Do not know
1	Technical/infrastructure barriers	O	O	O	O
2	Market barriers	O	O	O	O
3	Financing barriers	O	O	O	O
4	Socio-cultural barriers	O	O	O	O
5	Administrative and regulatory barriers	O	O	O	O
6	Lack of co-ordination between different authorities	O	O	O	O
7	High number of authorities involved	O	O	O	O
8	Lack of Political will	O	O	O	O
9	Lack of public awareness	O	O	O	O
10	lack of transparency about grid connection procedures	O	O	O	O

APPENDIX C: DISCRIMINTORY VALIDITY

Discriminant validity

	AT	PU	PEOU	COST	KNOWLADGE
AT	**0.749**				
PU	0.398	**0.66**			
PEOU	0.243	0.125	**0.64**		
COST	0.265	0.213	0.196	**0.785**	
KNOWLADGE	0.138	0.356	0.113	0.165	**0.684**

LIST OF PUBLICATIONS AND PAPERS PRESENTED

ISI publications:

1- Kardooni, R., Yusoff, S. B., & Kari, F. B. (2015). Barriers to Renewable Energy Development: Five Fuel Policy in Malaysia. *Energy & Environment*, *26*(8), 1353-1362.

2- Kardooni, R., Yusoff, S. B., & Kari, F. B. (2016). Renewable energy technology acceptance in Peninsular Malaysia. Energy Policy, 88, 1-10.

3- Solaymani, S., Kardooni, R., Yusoff, S. B., & Kari, F. (2015). The impacts of climate change policies on the transportation sector. Energy, 81, 719-728.