UNIVERSITI PUTRA MALAYSIA

FACTORS INFLUENCING INTENTION TO INSTALL SOLAR PHOTOVOLTAIC AMONG HOUSEHOLDS IN THE KLANG VALLEY, MALAYSIA

NUR SHAZLEEN ILYANA BINTI SHARIFUDDIN

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

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December 2021

Chair   : Norzalina Zainudin, PhD
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For decades, Malaysia depend heavily on fossil fuels as the main energy sources to generate energy. To decrease dependency on fossil fuels sources and support Sustainable Development Goal (SDG) 7, Malaysia has implemented several renewable energy program, particularly solar program. The newest solar program introduced was Net Energy Metering (NEM) program, a revised program from previous progam which was Feed-in Tariff (FiT) program. Even though many aspect have been improved in NEM program, the adoption rate for solar PV among households still remains low. Thus, this study was necessary to examine various factors that are assumed to influence the intention of households in the Klang Valley to install solar PV. The Theory of Planned Behaviour has been extended by adding perceived cost as new variable in an attempt to identify behavioural intention towards the installation of solar PV in Klang Valley. This study empirically aims to examine how attitude, subjective norm, perceived behavioural control and perceived cost contribute to the behavioural intention of using solar PV in Klang Valley, Malaysia. A total of 500 questionnaires have been distributed at 5 selected local authority areas in Klang Valley using disproportionate stratified random sampling. A 410 responses were analysed using Partial Least Square Structural Equation Modelling (PLS-SEM). The findings of this study showed that attitude, subjective norm, perceived behavioural control and perceived cost have a significant influence on intention to install solar PV. Besides, the result demonstrated that subjective norm and perceived cost are positively mediated by attitude in influencing intention to install solar PV. The findings have contributed towards the advancement of knowledge in the field of solar PV under Net Energy Metering (NEM) programme. Besides, thesefindings also are useful for policy makers and solar PV marketers to strategize their plan to increase households adoption rate of solar PV in Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

FAKTOR-FAKTOR YANG MEMPENGARUHI NIAT MEMASANG SOLAR PHOTOVOLTAIC (PV) DALAM KALANGAN ISI RUMAH DI LEMBAH KLANG, MALAYSIA

Oleh

NUR SHAZLEEN ILYANA BINTI SHARIFUDDIN

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Selama beberapa dekad, Malaysia sangat bergantung pada bahan bakar fosil sebagai sumber tenaga utama untuk menjana tenaga. Untuk mengurangkan pergantungan kepada sumber bahan api fosil dan menyokong Matlamat Pembangunan Lestari 7 (SDG) 7, Malaysia telah melaksanakan beberapa program tenaga boleh diperbaharui, terutamanya program solar. Program solar terbaharu yang diperkenalkan ialah program Pemeteran Tenaga Bersih (NEM), program yang telah ditambahbaik daripada program yang lepas, iaitu program Feed-in Tariff (FiT). Walaupun banyak aspek telah ditambah baik dalam program NEM, kadar penggunaan solar PV di kalangan isi rumah masih rendah. Justeru, kajian ini perlu untuk mengkaji pelbagai faktor yang diandaikan mempengaruhi niat isi rumah di Lembah Klang untuk memasang solar PV. Teori Tingkah Laku Terancang telah diperluaskan dalam usaha untuk mengenalpasti niat tingkah laku isi rumah terhadap pemasangan PV solar di Lembah Klang. Kajian ini secara empirikalnya bertujuan untuk mengkaji bagaimana sikap, norma subjektif, persepsi kawalan tingkah laku dan persepsi kos menyumbang kepada niat tingkah laku menggunakan solar PV di Lembah Klang, Malaysia. Sebanyak 500 borang soal selidik telah diedarkan di 5 kawasan Pihak Berkuasa Tempatan (PBT) terpilih di Lembah Klang menggunakan persampelan rawak berstrata tanpa mengikut nisbah. Sebanyak 410 maklumbalas telah dianalisis menggunakan Pemodelan Persamaan Struktur Persegi Separa Terkecil (PLS-SEM). Dapatan kajian ini menunjukkan bahawa sikap, norma subjektif, persepsi kawalan tingkah laku dan persepsi kos mempunyai pengaruh yang signifikan terhadap niat memasang solar PV. Selain itu, hasil kajian juga menunjukkan bahawa sikap adalah mekanisme pengantara bagi norma subjektif dan persepsi kos dalam mempengaruhi niat untuk memasang solar PV. Penemuan ini telah menyumbang ke arah kemajuan pengetahuan dalam bidang PV solar di bawah program Pemeteran Tenaga Bersih (NEM). Selain itu, penemuan ini berguna bagi pembuat dasar dan pemasar solar PV untuk menyusun strategi rancangan mereka untuk meningkatkan kadar penggunaan solar PV isi rumah di Malaysia

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

AC	Alternating Current
AVE	Average Variance Extracted
CH_4	Methane
CI	Confidence Interval
CO	Carbon Monoxide
CO^2	Carbon Dioxide
CR	Composite Realibility
DC	Direct Current
DIT	Diffusion Innovation Theory
EC	Energy Commission
f^2	Effect Size
FDP	Fifth Fuel Diversification Policy
FiT	Feed-In Tariff
GHG	Greenhouse Gases
HTMT	Heterotrait-Monotrait Ratio of Correlations
MESTESCC	Ministry of Energy, Science, Technology, Environment, and Climate Change
MW	Megawatt
N_2O	Nitrous Oxide
NEM	Net Energy Metering
NEM	Net Energy Metering
NO_x	Nitrogen Oxide Gas Components
PBT	Local Authorities
PLS-SEM	Partial Least Square - Structural Equation Modelling

PV	Photovoltaic
Q^2	Predictive Relevance
R^2	Coefficient of Determination
RE	Renewable Energy
RMK-11	Eleventh Malaysia Plan
SDG 7	Seventh Sustainable Development Goal
SEDA	Sustainable Energy Development Authority
SESB	Sabah Electricity Sdn. Bhd.
SESCO	Sarawak Electricity Supply Corp.
SPSS	Statistical Package for Social Sciences
TNB	Tenaga Nasional Berhad
TPB	Theory of Planned Behaviour
TRA	Theory of Reason Action
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variance Inflator Factor

CHAPTER 1

INTRODUCTION

There may be a preamble at the beginning of a chapter. The purpose may be to introduce the themes of the main headings.

1.1 Introduction

Global warming has become a great debated topic in global discussion. The growth of global warming that leads to irreversible climate change is contributed by the generation of energy across the world. The energy sector is the catalyst for the development of a country, especially in a rapidly developing country such as Malaysia. It is estimated that 53% of the global energy consumption will be increased by 2030. Therefore, 70% of the growth in demand are used by developing countries including Malaysia (Oh, Pang & Chua, 2010). Specifically, Malaysia energy demand has increased each year from 2015 until 2018 as shown in Figure 1.1.
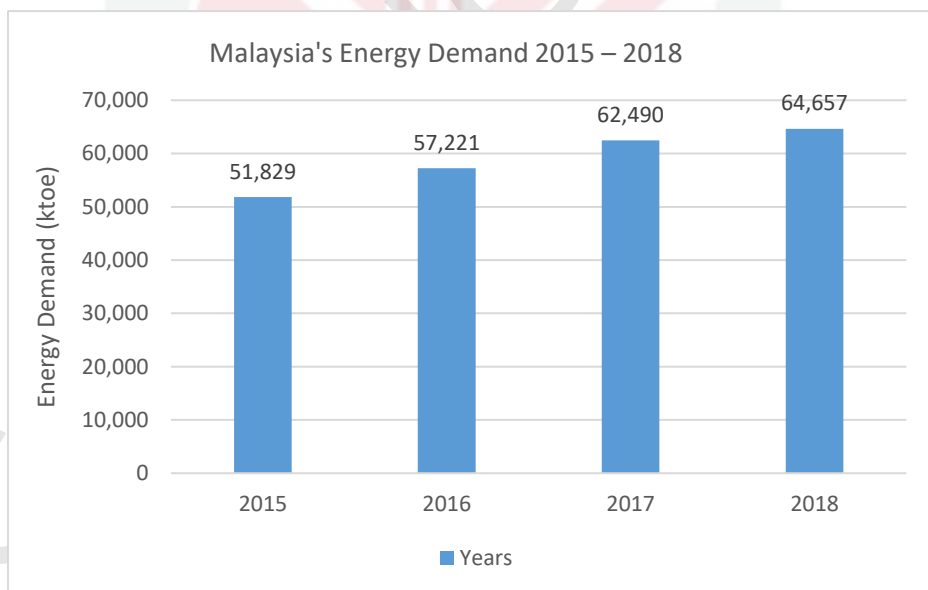
Figure 1.1: Malaysia Energy Demand 2015 – 2018 (Source: MEIH, 2021)

The use of automation and artificial intelligence to trigger the economy of the country has increase the energy demand extensively (Balatsky, 2019). Not only that, it is also expected that the Malaysian population will reach 36.4 million in 2030, an increase of 13.8% from 2017 (Euromonitor International, 2019), as well

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as an increase in energy demand (Energy Commission (2018). More greenhouse gases will be produced as energy generation by non-renewable resources will be increased to cope with the high energy demand. Without sufficient energy, it would impede the growth and development of the country. From 2015 until 2018 (see Figure 1.2), Malaysia recorded an increasing trend of energy supply to cope with the country's energy demand. Figure 1.2 shows the details of Malaysia's energy supply from 2015 until 2018. The increasing trends of energy demand and energy supply have sparked concerns among energy policymakers as this increase will affect the country's energy security as the prominent energy source of most countries over the world is from fossil fuels, which will deplete soon. Malaysia is not excluded from facing the same issues as its energy sources mostly come from fossil fuels.
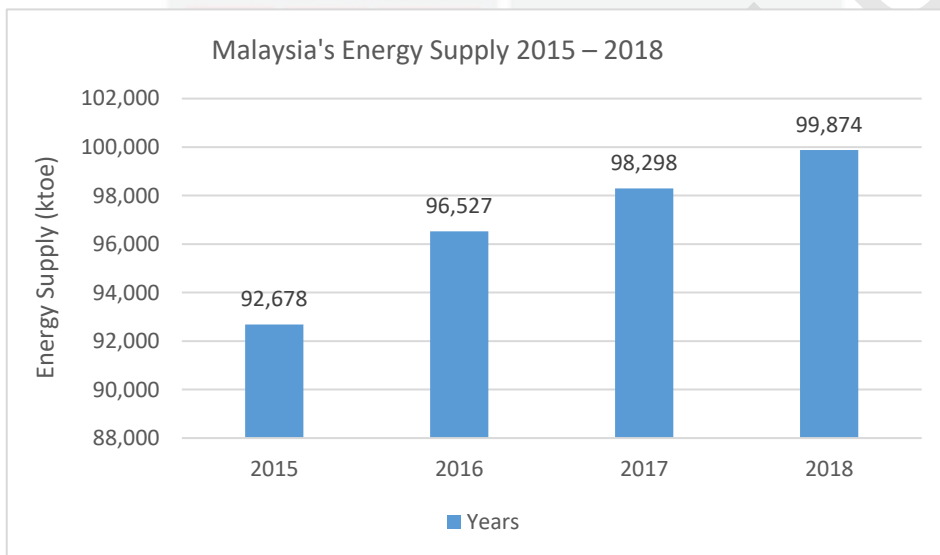
Figure 1.2: Malaysia's Energy Supply 2015 – 2018 (Source: MEIH, 2021)

Generally, energy resources consist of two categories, which are renewable and non-renewable energy resources. Renewable energy is a resource that is available without limited quantity and can be easily replaced by the environment, meanwhile non-renewable energy such as fossil fuel and natural gas cannot be easily replaced by the environment. Biomass, wind, geothermal, water (hydro) and solar are the examples of renewable energy, while fossil fuel and natural gas are categories as non-renewable energy resources.

Malaysia is heavily reliant on energy to meet industries and domestic sectors's energy demands as these sectors provide economic growth and improve the people's quality of life. The main energy sources for most of the countries including Malaysia was fossil fuel, natural gas and coal which comes from non-renewable energy sources (SEDA, 2018). These can be proved by referring to Figure 1.3, which shows that over the years, non-renewable energy such as gas,

oil, and coal have become prominent sources of energy in Malaysia. Malaysia relies heavily on these non-renewable sources because of the lower energy cost factor as compared to renewable energy sources (Sommerfeld, Buys, Mengersen & Vine, 2017). This scenario has had a very serious impact on the supply of natural resources as well as the quality of the environment (Nadimi & Tokimatsu, 2017). Fossil fuel power plants release harmful greenhouse gases such as carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4) to the environment. Furthermore, the excessive use of non-renewable energy resources speeds up the depletion of associated resources (Nadimi & Tokimatsu, 2017).
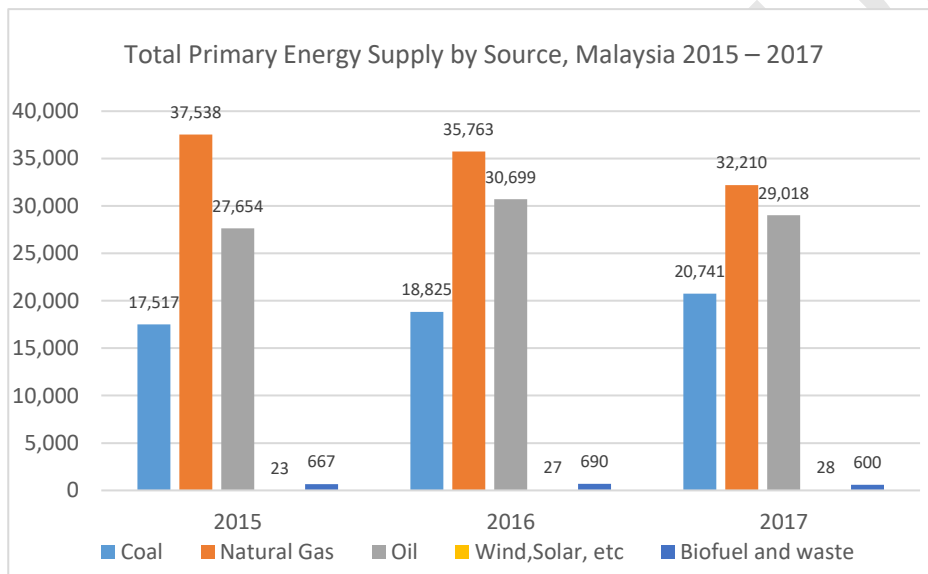
Figure 1.3: Total Primary Energy Supply by Source in Malaysia 2015 – 2017
(Source: International Energy Agency (IEA), 2019)

Based on Table 1.1, Malaysia recorded an increasing amount of carbon dioxide release from 2015 until 2018. This trend gave a huge impact on environmental quality. These greenhouse gases (GHG) directly affect global climate change, which will affect the amount and pattern of rainfalls, causing extreme events such as prolonged droughts and floods, as well as impacting the increment of global temperature that will cause global warming (Energy Commission (2018). International Energy Agency also supports the energy conservation agenda and states that the 60% of GHG emission were resulted from human activities such as energy generation from natural resources (International Energy Agency, 2014).

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Table 1.1: Malaysia's Carbon Dioxide Emission 2014 – 2018

Year	Amount of Carbon Dioxide
Dec. 31, 2014	241.06M
Dec. 31, 2015	246.78M
Dec. 31, 2016	242.02M
Dec. 31, 2017	242.85M
Dec. 31, 2018	251.52M

(Source: Statistical Review of World Energy, 2020)

Therefore, energy generation from non-renewable energy resources was unsustainable as this type of resource depleting each year and cannot easily replenish by the environment (US Environmental Protection Agency, 2014). The depletion of non-renewable energy is one of the biggest threats to the energy security of Malaysia and other countries over the world (Vaka, Walvekar, Rasheed and Khalid, 2020). This is because non-renewable energy is the main energy supply for most countries including Malaysia and its depletion will interrupt the availability of national energy sources. Therefore, it has become a global issue that needs to be addressed immediately to secure world energy security and further combat global climate change.

To fix Malaysia's fossil-fuel dependency problem and at the same time mitigate climate change, the country has switched and diversified its energy mix with greener energy sources like renewable energy, in line with the nation's intention and effort to shift towards a greener energy policy. The government of Malaysia has introduced renewable energy as the fifth energy option to diversify national energy resources in the which was introduced in 1999 (Jafar et al., 2008).

Malaysia's commitment in the Eleventh Malaysia Plan (RMK-11) (2016–2020) is to stimulate the country's green growth and improve the socio-economy of the community in a sustainable environment. In line with this, at the end of 2016, Malaysia introduced the Net Energy Metering (NEM) programme after the Feed-in Tariff (FiT) programme to encourage usage of green and sustainable energy generation using solar photovoltaic (PV) technology. Solar PV has been seen as a potential renewable technology to be developed and deployed among community in Malaysia. This is because solar PV only needs sunlight to produce energy or electricity and it can be install on the rooftop of the building. If all communities in Malaysia install solar PV, it could give significant contribution in achieving national renewable energy target. Besides, generation of electricity from solar PV could minimize or lessen the used of fossil fuel to generate electricity. As the result, the lesser the use of non-renewable energy such as fossil fuel, the lesser the amount of greenhouse gassed released.

The continuation of solar program such as NEM programme was a great decision as this program helps in accelerate penetration of solar PV in the market and increase deployment of solar PV. In turn, it is expected to give contribution in achieving the national renewable energy (RE) target and reducing dependency on fossil fuels. The FiT programme had been implemented since 2011 under the Renewable Energy Act 2011 with the objective to encourage the use of renewable energy in generating sustainable electricity. Now, the NEM programme, which is a solar photovoltaic (PV) programme, is carried out to complement the FiT mechanism and encourage the deployment of RE as meted out in the Eleventh Malaysia Plan (RMK-11). NEM is executed by the Ministry of Energy, Science, Technology, Environment, and Climate Change (MESTESCC), regulated by the Energy Commission (EC), with the Sustainable Energy Development Authority (SEDA) Malaysia as the implementing agency. NEM is an approved five-year programme implemented since November 2016 and planned to span up to 2020. Based on Table 1.2, 90 MW capacity is released each year for Peninsular Malaysia and 10 MW for Sabah. Therefore, a total of 500 MW capacity are allocated for applications of NEM.

Table 1.2: Quota Allocation under the NEM Programme

Location		Peninsular Malaysia					Sabah and FT Labuan				
Year		2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Category of Consumers (MW)	Domestic/Residential	20	20	20	20	20	4	4	4	4	4
	Commercial	35	35	35	35	35	4	4	4	4	4
	Industrial	35	35	35	35	35	2	2	2	2	2
Sum (MW)		90	90	90	90	90	10	10	10	10	10
Total (MW)		450 + 50 = 500									

(Source: SEDA, 2018)

The concept of NEM is that the energy produced by the installed solar PV system will be consumed first, and any excess will be exported and sold to licenced distributors such as TNB and SESB at the prevailing displaced cost prescribed by the EC (SEDA, 2016). This programme is available to all domestic, commercial, and industrial sectors that are TNB (Peninsular Malaysia) or SESB customers (Sabah and FT Labuan). PV systems can only be installed on available rooftops or car porches within residents' own premises. Based on the experience with FiT, solar PV is a technology that requires minimal construction and has a high take-up rate as compared to other RE technologies (SEDA, 2016). Thus, solar PV is the only technology whereby the public at large can play their role in addressing climate change by reducing energy consumption from electricity generated by fossil fuel-powered generators.

1.2 Problem Statement

To decrease the dependency of non-renewable energy, Malaysia has introduced Fifth Fuel Energy Policy in the Eighth Malaysia Plan (2001 – 2005), where renewable energy such as biomass, solar, wind, and hydropower were regarded as the fifth fuels in the national energy mix. Solar PV has received a lot of interest since it is viewed as the most suited and practical technology for generating electricity from renewable energy sources, and because Malaysia has a tropical rainforest environment with plenty of sunshine all year. Therefore, it make solar PV highly suitable for the development of solar energy (Abdul, 2011). Looking at the potential of solar PV, the Malaysian government introduced the FiT programme with a duration of five years from 2011 – 2016. In late 2016, the NEM programme was introduced as a complement to the FiT programme to encourage clean energy generation using solar PV. The NEM programme differs from the FiT programme, whereby the former enables users to first consume their generated electricity from solar PV and the excess electricity will be sold to power utility companies at prevailing displaced costs. In contrast, FiT only allows users to sell their generated electricity to power utility companies at a fixed premium price for a specific duration. The NEM programme has benefits for consumers, especially households, in reducing electricity bills and at the same time, generate passive income by selling their excess electricity. Even though households energy consumption are not too high when compared to industries (MEIH, 2021), the trend of electricity consumption by households are expected to increase over the years. By installing solar PV, electricity generated by solar PV can be used by the household, therefore it helps in reducing electricity consumption. The role of households were very important in helping deployment of solar PV and reduce electricity consumption as they were the largest number of electricity consumers in each country around the world.

Moreover, electricity consumers in the domestic sector in Malaysia represent 82% as compared to the commercial sector (1.7%), the industrial sector (0.4%), and others (0.6%). If every household can take responsibility and support renewable energy activities at home, it will give a huge impact on achieving a more sustainable energy management goal in the future. As a result, the inclusion of households in the NEM programme is viewed as a progressive step that helps reduce energy consumption while maintaining consumer comfort. The use of NEM not only helps households reduce their electricity bills, but it also contributes excess energy to the grid for sale, thereby reducing energy generation from natural resources. (SEDA, 2016). Moreover, Alrashoud and Tokimatsu (2019) and Mansur, Baharudin & Ali (2018a) stated that investing in solar PV fields will provide long-term profitable investments. The NEM programme initiative has great potential in encouraging home solar PV users and contributes to the conservation of the country's energy resources.

Furthermore, looking at the supply and production aspects, the development of environmental friendly products such as solar PV has begun to grow in Malaysia. However, this development does not appear to be consistent with the level of understanding, awareness, and acceptance of users, which still remains a

question. The green innovation product market, especially solar PV products, is seen to grow at a slower pace than the usual products on the market. This trend can be proven by the lower uptake quota of solar PV from 2016 – 2018 allocated by the government in Table 1.3.

Table 1.3: Quota Taken by Sectors from 2016 – 2018

Quota Allocated and Taken							
Categories of Sector	Allocation Each Year	Taken Each Year			Sum (MW)	Total Sum (MW)	Quota Balance (MW)
		2016	2017	2018			
Domestic/ Residential (MW)	24	0.60 2.5%	1.54 6.4%	0.23 1.0%	2.37 3.3%	27.80 9.27 %	500 - 27.80 = 472.20
Commercial (MW)	39	1.96 5.0%	5.65 14.5 %	1.18 3.0%	8.79 7.5%		94.44%
Industrial (MW)	37	2.72 7.4%	11.05 29.9 %	2.87 7.8%	16.64 15.0%		

(Source: SEDA, 2018)

The government allocated 72 MW quota for domestic consumers until 2018, but only 3.3% of the quota had been used by installing solar PV on their rooftops (SEDA, 2018). Meanwhile, only 7.5% quota for the commercial sector and 15.0% for the industrial sector had been used. This trend showed that only a few percent of consumers installed solar PV on their rooftops, and it raises questions on the factors that lead to the lack of involvement of the Malaysian community, especially households, in the NEM programme.

This is seen as a necessary change not only in terms of government spending and policy, but also in changing consumer behaviour and consumer acceptance. Studies in many countries have shown that consumer acceptance is a major challenge for manufacturers to develop and market green innovation products such as solar PV (Galarraga, González-Eguino & Markandya, 2010). As a result, many countries implementing green innovation products face difficulties and often rely on government policy support in the form of subsidies and tax incentives (Sijm, 2002). In this context, there are many barriers from the behavioural aspect that influence consumer acceptance of green products. Some of the barriers highlighted by past research were lack of trust (Qureshi, Ullah & Arentsen, 2017), high cost (Karakaya & Sriwannawit, 2015), and lack of adequate knowledge (Karakaya & Sriwannawit, 2015). Therefore, this study is interested in exploring how behavioural and economic factors will influence household intention to install solar PV under the NEM programme in Klang Valley, Malaysia. Various studies such as Abreu, Wingartz and Hardy (2019), Sun, Wang, Huang and Ho (2020), Alrashoud and Tokimatsu (2019) and

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Qureshi et al. (2017) from other countries have been carried to address the factors that may influence intention to install solar PV.

In Malaysia, several studies have been conducted by researchers regarding the NEM programme from different perspectives. The NEM programme has been analysed from financial aspects by Razali, Abdullah, Hassan & Hussin (2019) in their study on comparing new and previous NEM programmes in Malaysia. Their aim was to investigate the potential financial return of the new NEM 2019 in terms of net present cost and electricity cost savings. Meanwhile, Mansur et al. (2018a) and Mansur, Baharudin, and Ali (2018b) conducted a research to evaluate the application of solar PV under the NEM programme of residential houses from the economic aspect.

However, currently only a few research has been done to analyse the acceptance of solar PV based on the NEM programme from behavioural and economic perspectives. From the behavioural perspective, a previous study by Lau, Choong, Wei, Seow, Choong, Senadjki & Ching (2020) examined the factors that influenced behavioural intention to adopt solar PV using the Unified Theory of Acceptance and Use of Technology (UTAUT). In contrast, this research analyses the acceptance of solar PV using the Model that has been extended from Theory of Planned Behaviour for this study. Additionally, this research not only examines behaviours, but also examine costs. From the previous studies, it was found that cost is a significant factor that contributes to the withdrawal of intention to adopt solar PV. For this reason, this study insists to extend the Theory of Planned Behaviour (TPB) on the behaviour and economic aspects by including the variable of perceived cost. This study intends to fill the gap or to complement previous studies, whereby the research by Lau et al. (2020) did not examine the perceived cost of solar PV based on the NEM programme. This imperative study evaluates the household acceptance of the NEM program from the behavioural perspective using intention. This study will provide in-depth knowledge and understanding of consumer acceptance regarding solar PV by evaluating the aspects of attitude, subjective norm, perceived behavioural control, perceived cost, and intention to install solar PV using the Model that has been extended from Theory of Planned Behaviour.

Attitude is found to has a direct positive influence on the intention to purchase solar PV among households (Abreu et al., 2019; Sun et al., 2020). Two previous studies conducted their research in the United States (US) and Taiwan, respectively, and found the same result, which was attitude has a direct and significant impact on forming intention to purchase solar PV. In other words, customers with a positive attitude towards solar PV have a strong intention to install solar PV (Ahmad, Mat Tahar, Cheng & Yao, 2017). A research that took place in Malaysia by Ahmad et al. (2017) regarding public acceptance of solar PV technology under the FiT programme revealed that attitude has an impact on the intention for solar PV installation. Looking at the positive direct influence of attitude in the installation of solar PV, it is important to test whether attitude has a significant influence on intention to install solar PV under NEM program in Klang Valley.

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Meanwhile, attitude also has been found to be a mediator in many fields of study. For instances, green products (Ayu Wulandari et al., 2015), social media influencers (Lim et al., 2017), marketing (Ngo & Nguyen, 2021) and even in the field of energy efficiency (Siwar, Zainudin, Choy & Chamhuri, 2016) have proved that attitude mediated predictors variables in many studies. Many studies of solar PV have been conducted in other countries regarding mediation effect of attitude. However, only a few studies have been tested attitude as mediator in Malaysia, especially in the field of solar PV. Due to the impact of attitude in mediating the variables, it is imperative to investigate the mediating role of attitude towards the relationship between subjective norm, perceived behavioural control, and perceived cost in influencing Malaysian households' solar PV installation intention. This study is believed can contribute to fill the gaps in the literature of attitude as mediator in the field of solar PV. Besides, this study can give significant contribution to the Theory of Planned Behaviour in the context of solar energy.

Meanwhile, subjective norm, or also regarded as social pressure from peers, family or close neighbours, has been identified as a significant factor influencing consumers' behavioural intention in many disciplines of studies. For example, Sulaiman, Chan & Ong (2019) found that subjective norm strongly impacts students' intention to engage in recycling behaviour. Husin, Ismail and Ab Rahman (2016) revealed a significant relationship between subjective norm and consumers' intention to purchase family takaful schemes among Malaysian Muslims. Meanwhile, the study by Hasbullah, Osman, Abdullah, Salahuddin, Ramlee and Soha (2016) proved that peers or friends' opinions significantly influence someone's intention to do online shopping. Specifically, in solar PV, research by Abreu et al., (2019) and Aggarwal et al., (2019) showed that people are highly influenced by family, friends, and close friends to install solar PV. This scenario reveals the important role of social norms in helping the diffusion of a green technology, particularly solar PV. Therefore, in this study, subjective norm will be examined to observe its impact on the intention to install solar PV among households in Klang Valley, Malaysia.

Next, perceived behavioural control is found to be one of the determiners of intention in green behaviour. Ajzen (1985) stated that an individual's intentions will be influenced by the opportunities and resources required even if the individual has a positive attitude to perform certain behaviours. This statement was supported by Sun et al. (2018), where they claimed that people have the intention intent to install solar PV when they are offered with incentives by the government. Mufidah, Jiang, Lin, Chin, Rachmaniati and Persada (2018) in their study stated that most people who perceive engaging in green behaviour is easy tend to engage in such behaviour. Therefore, perceived behavioural control needs to be studied because solar PV is a new green innovation technology that requires resources such as finance and control capabilities from consumers.

The major barrier to adopt solar PV in developing countries is found to be the perceived high cost by customers, which in turn impede the diffusion of solar PV (Qureshi et al., 2017; Khan & Latif, 2010). They said that the perceived high cost of solar PV might cause consumers to reject the adoption of solar PV regardless of its clean and environmentally friendly characteristics. Besides, people become

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cost-sensitive because the installation of solar PV is a long-term investment with a high capital cost. In developed countries like the Netherlands, the researchers also found perceived cost as the reason for households to reject the adoption of solar PV (Vasseur & Kemp, 2015). For household adopters, they consider the cost of solar PV as affordable, whereas for non-adopters, they consider the cost of solar PV as too high. This shows that intention to adopt solar PV depends on attribute perception. Therefore, this study aims to investigate the effect of perceived cost in influencing solar PV installation among households in Malaysia.

In this study, the researcher will use TPB to investigate behavioural intention towards installation of solar PV. This is because TPB explains behavioural intention and behaviour better than the Theory of Reason Action (TRA) (Kang, Fortin, Hahn, Hyun & Eom, 2006). The inclusion of perceived behavioural control such as individuals' resources, knowledge, and ability in the investigation of household intention to use solar PV will reveal more accurate predictions of behaviour. This is because to engage with this behaviour requires resources like money as solar PV is quite expensive in the market. Therefore, TPB is the most relevant theory to be used in this research.

1.3 Research Questions

1. Is there any relationship between attitude, subjective norm, perceived behaviour control, perceived cost and intention of installing solar PV among household?
2. Does attitude mediate the relationship between subjective norm, perceived behaviour control, perceived cost and intention of installing solar PV among household?

1.4 Research Objectives

1.4.1 General research objective

Generally, this study aim to investigate the factors that influence the intention to install solar PV and the Net Energy Metering program in Klang Valley, Malaysia.

1.4.2 Specific research objectives

1. To determine the relationship between attitude, subjective norm, perceived behavioural control, perceived cost and intention to install solar PV.

2. To examine the mediating effect of attitude between subjective norm, perceived behavioural control, perceived cost and intention to install solar PV.

1.5   Research Significance

This study is significant as its findings contribute in the practical and academic aspect as follows:

1.5.1   Practical Aspect

This study can add value in several aspects such as it gives benefits to consumers and marketers. Through this research, consumers will have more knowledge on green energy innovative products, especially solar PV. The study of consumer behaviour becomes crucial as it can help to create social awareness, educate and protect customers (Blackwell et al., 2006). This study will also enlighten consumers about the advantages of going green and the needs to support green innovative technology.

For marketers, they can utilise the information from this study to strategize their marketing plan to persuade consumers to change their intention into actual purchasing behaviour. Thus, it will ensure sustainable business growth in the renewable energy industry. For example, if the result shows that subjective norm is the top predictor of purchase intention, marketers can utilise social media, such as Facebook, Instagram, and Twitter, to share the information to the public through hired influencer such as artist. Besides, this study is useful to Malaysian policymakers in understanding the behaviour of Malaysian households towards solar PV. The implementation of good and effective policies must come from a clear understanding of a fundamental phenomenon or problem for the society as a whole. Therefore, this study provides input to policymakers to effectively address the factors that may influence intention positively and negatively or the barriers and drivers towards intention to install solar PV. The results of this study can contribute to actual assessment of green technology by giving a true picture of factors that influence the installation of solar PV. Furthermore, based on the result of the study, policymakers can tackle households to get involved in generating clean energy by addressing their barriers and revising the NEM regulation or introducing new incentives. Besides, this study can certainly provide a clearer guideline to increase the marketability of the NEM programme in the future and support the Eleventh Malaysia Plan (RMK-11). It also further supports in enhancing demand management side and the Seventh Sustainable Development Goal (SDG 7) in Malaysia, which is to ensure access to affordable, reliable, sustainable, and modern energy for all.

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1.5.2 Academic Aspect

This study is also significant important for the theoretical advancement, especially in terms of the Theory of Planned Behaviour. This study have extend Theory of Planned Behaviour by adding perceived cost as one of the variables and adding attitude as a mediator under the study of the NEM programme. The reason of adding perceived cost in this study is because perceived cost has been proved to be one of the major barriers in the adoption of solar PV in others developing countries (Qureshi et al., 2017; Khan & Latif, 2010). This is because solar PV is a green technology that has relatively high initial price. In Malaysia, there is no study has been conducted to see the influence of perceived cost in the adoption of solar PV. Meanwhile, attitude was added as mediator to test the effect of attitude in mediating the relationship bertween subjective norm, perceived behavioural control, perceived cost and intention to install solar PV in Malaysia. The effect of attitude as mediator has been vastly investigate in other countries, yet still underdevelop in Malaysia.

Besides, this research enhances the model of previous studies on factors that influence the installation intention in terms of green innovation products in general or solar PV in particular. In addition, this study can increase knowledge related to green consumption that is still underdeveloped in Malaysia. In particular, the study is able to provide added value and in-depth understanding in the field of solar PV under the NEM programme in Malaysia. The findings of the study are expected to increase reading materials in the forms of papers, articles, journals, and books for the purpose of improving and contributing to knowledge in the relevant field.

1.6 Research Scope

The scope of the study is to guide the researcher in facilitating the study to be conducted within a specific scope. In this study, the first scope of the study is the intention or desire of consumers to use solar PV among households in Malaysia. This study focuses on TPB to explain the correlation between factors such as attitude, subjective norms, and behavioural control in influencing the desire or intention to use solar PV.

The respondents selected in this study are households as this sector has the largest number of electricity consumers as compared to commercial and industrial users. Results from this study were useful for marketers and policymakers to strategize their plan to change intention into actual behaviour. This study used quantitative methods by distributing 500 questionnaires face-to-face to the respondents. This study also was conducted around the Klang Valley only.

1.7 Conceptual and Operational Definition

1.7.1 Attitude

Conceptual definition: Attitude is defined as "the degree to which a person has a favourable or unfavourable evaluation towards the behaviour" (Ajzen, 1991; Kim & Chung, 2011).

Operational definition: In this study, attitude is the favourable perception of consumers of using solar PV.

1.7.2 Subjective Norm

Conceptual definition: Subjective norm is a perceived social pressure to perform or not perform a behaviour (Ajzen, 1991). Subjective norm also can be define as a social influence of family, peers, close friends to the person in a decision making process to adopt a particular behaviour (Al-Swidi, Huque, Hafeez & Shariff, 2014).

Operational definition: In this study, subjective norm is a pressure from peers, family, and important people felt by someone to use solar PV. If there is a great support from family, peers and important person to use solar PV, the consumer will use the solar PV.

1.7.3 Perceived Behavioural Control

Conceptual definition: Perceived behavioural control is someone perception of controlling their ability to perform a particular behaviour. It is also refers to "the perceived ease or difficulty of performing the behaviour" (Ajzen, 1991). Chen (2007) and Kang et al. (2006) defined perceived behaviour control as the degree of control that an individual perceives over performing the behaviour.

Operational definition: In this study, perceived behavioural control is individual's perception of her/his control to install solar PV. It is also reflects on someone's control over her/his resources, knowledge about the solar PV and ability to install solar PV.

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1.7.4   Perceived Cost

Conceptual definition: The perceived cost of an action is defined as the unit cost which a consumer assumes he incurs by undertaking a particular action (Neuburger, 1971, Alam, Nik Hashim, Rasyid, Omar, Ahsan & Ismail., 2014).

Operational definition: In this study, perceived cost is individual perception of solar system cost that include initial investment for setting the solar system and their periodic maintenance costs.

1.7.5   Behavioural Intention

Conceptual definition: Behavioral intention is defined as the possibility that a person's perceived or "subjective likelihood that he or she will engage in a certain behaviour" (Ajzen, 1991). In other words, intention also act as motivational antecedent to influence behaviour (Ramayah, Lee & Mohamad, 2010).

Operational definition: In this study, behavioural intention is a motivation, an effort of individual to install solar PV if they control whether to perform or not to perform the behaviour in the future.

1.8   Conclusion

In general, this chapter discussed the introduction of the study, problem statement, research question, research objective, research significance, scope of study and conceptual and operational definition. The next chapter discussed some of the previous studies related to this study.

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