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An Extended Model of the Theory of Planned Behavior to Predict Households Response to Net Energy Metering Program in Urban Malaysia

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Abstract

Malaysian government have seen solar Photovoltaic (PV) as one of the most promising renewable energy technology to combat climate change and decrease dependency of fossil fuels. At the end of 2016, Net Energy Metering (NEM) program has been implemented to encourage the use of solar PV to produce electricity in a greener way. However, the adoption rate for solar Photovoltaic (PV) under NEM Program among households still remain low. The factors of low participation of household in NEM program is an issue that need to be addressed. Therefore, in this research, the factors that affect household intention to adopt solar PV were studied, using Extended Theory of Planned Behaviour (ETPB) which consist of four variables which were attitude, subjective norm, perceived behavioural control and perceived cost. This study was conducted in the Klang Valley, Malaysia. The 500 questionnaires were distributed using non-probability stratified random sampling at the selected area in Klang Valley and yielded 410 respond rate. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to test the hypotheses. The results confirmed that attitude, subjective norm and perceived behavioural control have significant influence on intention to install solar PV. The findings also found that perceived cost has a positive influence on intention to install solar PV which differs from past studies. In the other words, perceived cost is not a barrier to the adoption of solar PV among household in Malaysia. Nevertheless, the findings have contributed towards the advancement of knowledge in the field of solar PV under the NEM program in Malaysia. Moreover, this study also contributes to the literature by adding new variable in TPB theory that are relevant to solar energy adoption. These findings also significantly contribute to those involved in the marketing of solar products.

Keywords: Net Energy Metering, Solar PV, Theory of Planned Behaviour

Introduction

The energy sector is the catalyst of development for a country, especially a developing country such as Malaysia. For most countries, including Malaysia, non- renewable energy sources such as coal, oil, and natural gas are the main sources of generating electricity. The impact of this scenario has resulted in very serious consequences on the supply of natural resources as well as the declining quality of the environment. A study by Li (2011) stated that electricity consumption not only puts pressure on dwindling fossil energy sources but also contributes to greenhouse gas emissions such as carbon dioxide (CO2), carbon monoxide (CO) and also nitrogen oxide gas components (NOx). The International Energy Agency also supports the energy-saving agenda and states that the energy sector is responsible for 60 percent of greenhouse gas emissions as a result of human activities (International Energy Agency, 2014).

Looking at these challenges, the government, through various ministries and agencies, has formulated and implemented policies and strategies to ensure the sustainability of energy resources and also reduce the impact of this sector on the environment. Moreover, in addressing this issue, the role of individuals or the household sector is seen as a potential group in efforts to help reduce total energy consumption. Households or domestic consumers represent the largest number of consumers of electricity in each country. In Malaysia, electricity consumers in the domestic sector represented 82% compared to the commercial sector (1.7%), the industrial sector (0.4%) and others (0.6%). At the end of 2016, Malaysia launched the Net Energy Metering (NEM) program after the Feed-in Tariff (FiT) program to promote clean energy generation using solar PV. If every household takes responsibility and is positive towards this program in supporting renewable energy activities at home, this effort will have a great impact in achieving the goal of more sustainable energy management in the future. Thus, household participation in the NEM program is seen as an effort that can help reduce energy consumption without compromising consumer comfort. The use of solar panels not only help households in saving energy consumption but also contribute excess energy to the grid and in turn help reduce the negative impact on the environment (SEDA, 2016). Studies show that investing in the solar PV field will provide a profitable investment in the long run. Therefore, the NEM program initiative has great potential in encouraging solar PV users at home and, in turn, contributing to efforts to conserve the country's energy resources.

However, while many acknowledge the benefits of this innovative program to individuals as well as the environment, the market for PV solar products is found to be relatively slow. The development and innovation of these products are seen to be inconsistent with the level of acceptance and use among consumers (Prothero et al., 2011). Studies in most countries show consumer acceptance as 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 that implement green innovation products experience difficulties and often rely on government policy support in the form of subsidies and tax incentives (Sijm, 2002). Factors of product price or higher initial cost compared to other conventional products in the market (Shahnaei, 2012) also cause consumers not to buy or even delay the purchase even if consumers are aware of the benefits of green products. In addition, factors of attitude, subjective norms and perceived behavioural control were also found to influence the acceptance of green innovation products. However, previous studies

have found that the results of the three variables are inconsistent and require further study.

Looking at the problems of the above study as well, the study found that the Theory of Planned Behaviour should be highlighted in studying the intention of solar panel installation among households in urban Malaysia.

Research Framework

Theory of Planned Behavior (TPB)

Generally, the Theory of Planned Behavior was introduced by Ajzen (1991) to explain human behaviour based on the influence of several factors namely attitude, subjective norm and perceived behavioural control. These factors were proven to influence someone's intention and further affect their behaviour. Intention to perform behaviours of different kinds can be predicted with high accuracy from attitudes toward the behaviour, subjective norms, and perceived behavioural control.

Previously, TPB is found to be well supported by empirical evidence in predicting human behaviour. TPB has been applied extensively in many disciplines such as health (Asare, 2015), consumer green behaviour (Ko & Jin, 2017; Paul, Modi, & Patel, 2016), education (Chen et al., 2011) and management (Kang et al., 2006; Wu & Teng, 2011). Besides, some researches have been done in predicting behavioural intention toward green energy products such as solar PV. Abreu, Wingartz, & Hardy (2019) studied the adoption of solar PV among households in the USA. They found that attitude, subjective norm and perceived behaviour control has a positive influence on intention to adopt solar PV.

Another study has been carried out by Jayaraman, Paramasivan & Kiumarsi (2017) in which they investigate the reasons for low penetration on purchase of solar PV among Malaysian citizens. They concluded that factors of attitude, subjective norm and perceived behavioural control have an impact on intention to purchase solar PV. Thus, the previously mentioned studies proved that TPB applies to identify the consumer's intention toward desired behaviour. But, in Malaysia, there is still a lack of research regarding the intention to adopt solar PV under the NEM program. Therefore, the authors proposed an Extended Theory of Planned Behavior by adding an additional variable namely perceived cost in the original theoretical model of TPB to investigate the factors that influence installation intention of solar PV based on the NEM program. The proposed framework consists of five variables namely attitude, subjective norm, perceived behavioural control, perceived cost and intention (see Figure 1).

Attitude towards behaviour is defined as a state of individual perception of favourable or not favourable towards particular behaviour (Ajzen, 1991). Being favourable toward specific behaviour can be called as having a positive attitude toward a particular behaviour. An individual is more likely to engage in a certain behaviour if the individual has a positive attitude toward the engaged behaviour and vice versa. In this study, the aim is to figure out to what extent someone has favourable or not favourable toward installing solar PV. What consumers perceive of using solar PV was expected to influence the consumer's preference on the product. Subjective norm is one of the important constructs that may influence behaviour intention. It occurs when an individual's emotions, opinions or behaviours are affected by another individual or group. Social influence mainly refers to the person surrounding an individual such as family, peers, co-workers, a leader or even society. It measures the influence of social pressures on individuals to perform or not to perform a

particular behaviour (Ajzen, 1991). If the person perceived their most important person think solar PV is good, the person will buy the product.

Ajzen (1991) defined PBC as people's perception of difficulty or ease to perform the behaviour of interest. In the other words, people tend to perform the behaviour if there is no difficulty in doing so. As the name implies, perceived behavioural control (PBC) refers to the perception of an individual about their control ability such as opportunities and resources to perform the behaviour (Mufidah et al., 2018). Individuals' intentions will be influenced by the opportunities and resources required even if the individual has a positive attitude to perform certain behaviours (Ajzen, 1991). If an individual knows solar PV benefits and the solar PV provider, therefore he/she will install solar PV regardless of their unfavourable attitude towards solar PV. In other words, the more strongly someone can control their behaviour, the more likely they will engage in that particular behaviour (Fu et al., 2021).

Lastly, the authors also include perceived cost as a variable in this study. Perceived cost is customer perception about the cost of solar PV in terms of installation cost, upfront cost and maintenance cost. Perceived product cost plays a significant role in influencing the intention to uptake solar PV. Many consumers are not willing to buy solar PV due to high installation costs (Muhammad-Sukki et al., 2011). Therefore, it is important to include the perceived cost in the investigation of factors that influence consumers' intention (Dhewi et al., 2018).

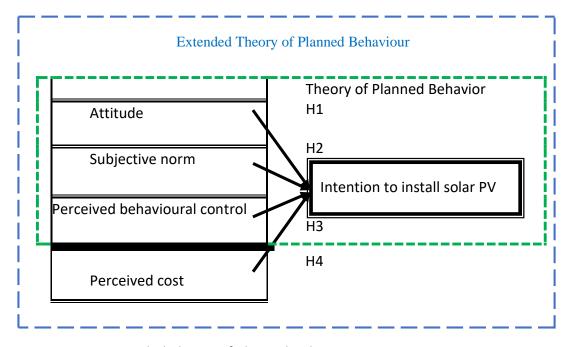


Figure 1: An Extended Theory of Planned Behavior

Hypothesis Development

Several studies have been carried out and found attitude has s significant impact on intention to install solar PV. When someone has a positive attitude towards installing solar PV, their intention to engage in installing solar PV is higher. If the consumers have a good perception to use the solar PV product, they will use the solar PV system. Abreu et al (2019); Sun et al (2020b) supported this idea and claimed attitude is the important variable in influencing intention to install solar PV. Ahmad et al (2017) demonstrated that intention is increased

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with increasing positivity toward installing solar PV. Therefore, the following hypothesis was proposed:

H1. Attitude has a significant relationship with the intention to install solar PV.

Previous studies show subjective norm has a significant impact on purchase intention. Many studies have been conducted from many perspectives. Chin et al (2018); Suki & Suki, (2015); Wu & Teng (2011); Islam (2018) demonstrated that people's purchase intentions are affected by the support from the society or their important person to engage in green behaviour. Incontrast, despite significant relationships, there were few previous studies that found the insignificant relationship between subjective norm and behavioural intention. Paul et al (2016); Ling (2013) found that subjective norm also has an indirect impact on the intention to purchase green products in general. Thus, these results revealed that the relationship between subjective norm and intention is inclusive. Therefore, the following hypothesis was proposed:

H2. Subjective norm has a significant relationship towards intention to install solar PV.

Perceived behavioural control (PBC) refers to the perception of an individual about their control ability such as opportunities and resources to perform the behaviour (Mufidah et al., 2018). Ajzen (1991) said that opportunities and resources required will influence an individual's intention even if the individual has a positive attitude towards certain behaviour. Someone should successfully undertake the behaviour if that person has opportunity, resources and intention to perform the behaviour. This idea is supported by Sun et al., (2020) where they found that workers in Taiwan have a high intention to purchase solar PV when the government offer an incentive to purchase solar PV. Therefore, the following hypothesis was proposed:

H3. Perceived behavioural control has significant relationship towards intention to install solar PV.

Perceived cost is about customer's perception on cost of solar PV. Studies in many field have proved that perceived cost plays critical role in how price of a product influence individual. It has been demonstrated by Abdul Aziz et al (2017) where they found that the higher the cost of solar PV, the lower the solar acceptance among consumer. Therefore, perceived cost is significant related to an individual's behavioural intention. Thus, the fourth hypothesis was proposed:

H4. Perceived cost has significant relationship towards intention to install solar PV.

Methodology

Sampling Method

The present study employed a quantitative research design with a cross- sectional study. The instrument used to collect data was a set of questionnaires built using adopt and adapt techniques from established questionnaires. The questionnaires were distributed using non-probability stratified random sampling at the selected area in Klang Valley which is made up of Kuala Lumpur, Putrajaya and several adjoining areas in the state of Selangor.

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The selection of five sampling area were made using simple random sampling. In this study, the respondents were household users and non-users of solar PV in selected urban areas.

Urban areas have been chosen to be the research location as solar PV is better known in urban areas rather than rural areas. The acceptance towards green products such as solar PV might be higher in urban areas as they may have more access to information on the green product (Saifullah et al., 2017). Besides, according to the Department of Statistics Malaysia (2016), households in urban areas have a higher income than households in the rural area. Therefore, households in urban areas were targeted to be research respondents as they have higher purchasing power rather than household in the rural area. This is because solar PV is a green product that has a respective high price. Apart from that, this research is carried out in the urban area is based on the market importance of the NEM program which is more concentrated in the major urban areas in Malaysia.

Measurement Instrument

The questionnaire used in this study was adopted from established studies that have been validated through a comprehensive analysis. The designed questionnaires are divided into six sections namely section A (attitude towards solar PV) adapted from Ajzen (1991) and Li (2011), section B (subjective norms towards solar PV) adapted from Ajzen (1991); Soyez (2012), section C (perceived behavioural control) adapted from Ajzen (1991); Soyez (2012), section D (perceived cost) adapted from Tornatzky and Klien (1982), section E (intention to install solar PV) adapted from Venkatesh, Thong & Xu (2012) and section F which revolves around questions related to the respondent's demographics. A 5-point Likert scale has been used by the researchers for obtaining genuine consumer responses. To investigate the research model and proposed hypotheses, Partial Least Square-Structural Equation Modelling (PLS-SEM) approach with Smart PLS software version 3 was used. In this present study, the researcher ran the PLS algorithm technique to assess the measurement model. Meanwhile, bootstrapping technique with 5000 re-samples were employed to assess the structural model. This technique has been suggested by Efron and Tishirani (1994) and Preacher and Hayes (2008) to draw, respectively, 1000 or 5000 bootstrap samples to yield a better result. The bigger the re-sample used, the more accurate the result willyield. Lastly, the blindfolding technique will be employed to assess the predictive power of the model.

Figure 2 provides a graphical representation of the tested SEM, highlighting the intensity of the relationships between the considered variables:

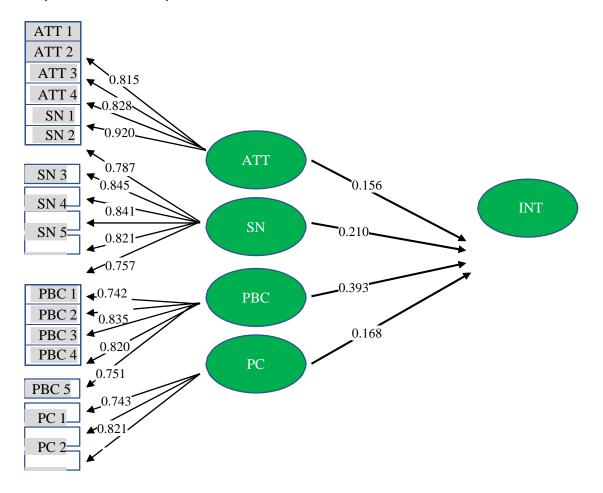


Figure 2: The estimated SEM path model

According to Hair et al (2016), the measurement model was examined by running internal consistency reliability of each construct, convergent validity, and discriminant validity. The internal consistency reliability shows the values of composite reliability (CR) for each latent construct should be equal or above 0.7 (Nunnally, 1978). The obtained result in Table 1 shows CR lies in between 0.76 and 0.94, which indicate good reliability.

T <u>able</u>	1:	Internal	consistency	reliability
Construc	t		Composite reliability	(CR)
Attitude			0.916	
Subjectiv	e norm		0.917	
Perceived	d behavioural d	control	0.885	
Perceived	d cost		0.863	
Intention			0.940	

Meanwhile, convergent validity shows the values of outer loading and average variance extracted (AVE) for each construct should be of the minimum standard of

0.50 and 0.708, respectively (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014). The analysis result in Table 2 shows the value of outer loading and AVE have achieved the required threshold value. Therefore, it was confirmed that all reflective constructs had acceptable convergent validity.

Table 2: Convergent validity assessment result

Construct	Items	Outer Load	ing	ΑV
			E	
Attitude	ATT 2	0.815		
	ATT 3	0.828		0.7
	ATT 4	0.920	33	
	ATT 5	0.857		
Subjective norm	SN 1	0.787		
	SN 2	0.845		
	SN 3	0.841		0.6
	SN 4	0.821	49	
	SN 5	0.757		
	SN 6	0.780		
Perceived	PBC 1	0.742		
behavioural control	PBC 2	0.835		
	PBC 3	0.820		0.6
			07	
	PBC 4	0.751		
	PBC 5	0.743		
Perceived cost	PC 1	0.821		
	PC 2	0.866		0.6
			79	
	PC 3	0.783		
Intention	INT 1	0.810		
	INT 2	0.825		
	INT 3	0.859		
	INT 4	0.842		
	INT 5	0.751		0.6
			34	
	INT 6	0.808		
	INT 7	0.802		
	INT 8	0.705		
	INT 9	0.752		

Note: ATT is Attitude; INT is Intention; PBC is Perceived Behavioural Control; PC is Perceived Control; SN is Subjective Norm

A part from that, discriminant validity is measured by using two criteria which were the Fornell-Lacker and Heterotrait-Monotrait ratio of correlation (HTMT). Table 3 depicts result of the Fornell-Lacker where the square root of the AVE of each construct was greater than its higher correlation with any other construct, as recommended by (Ramayah et al., 2018). Meanwhile, the result on Table 4 shows that all constructs have HTMT score below

than 0.85, as recommended by Kline (2011). Besides, the HTMTInference also exhibited that the confidence interval did not show a value of 1 in any of the constructs. Therefore, discriminant validity has been established.

Table 3: Fornell-Lacker Assessment Result

		ATT	INT	PBC	PC
	AT	0.856			
T					
	INT	0.491	0.796		
	PB	0.399	0.635	0.779	
C					
	PC	0.357	0.383	0.243	0.824
	SN	0.564	0.608	0.658	0.304

Note: ATT is Attitude; INT is Intention; PBC is Perceived Behavioural Control; PC is Perceived Control; SN is Subjective Norm

Table 4: Heterotrait-Monotrait Ratio of Correlations (HTMT) Assessment Result

		ATT	INT	PBC	PC
	ı	0.542			
NT		CI.85			
		(0.450,			
	0.6	23)			
	Р	0.452	0.711		
BC		CI.85	CI.85		
	(0.3	353,0.544)	(0.647,0.770)		
	P	0.431	0.447	0.292	
С		CI.85	CI.85	CI.85	
	(0.3	307,0.547)	(0.321,0.558)	(0.175,0.407)	
	S	0.630	0.662	0.757	0.358
N		CI.85	CI.85	CI.85	CI.85
	(0.5	555,0.700)	(0.589,0.728)	(0.691,0.814)	(0.221,0.480)

Note: ATT is Attitude; INT is Intention; PBC is Perceived Behavioural Control; PC is Perceived Control; SN is Subjective Norm

Result and Discussion

Table 5 present the result of respondent demographic of the present study. There were more female respondents than male respondents accounted for 239 female respondent (58.3% of the total sample) and 171 male respondents (41.7% of the total sample). Furthermore, there are 29.5% of the respondents were between 26 – 34 years old (n=121, 29.5%), followed by 35-44 years old (n=95, 23.2%), 18-25

years old (n=78, 19.0%), 45-54 years old (n=72, 17.6%), 55-64 years old (n=37, 9.0%) and 66 and above years old (n=7, 1.7%). More than 50% of the total respondents were Malay (n=311, 75.9%), followed by Chinese (n=53, 12.9%), Indian (n=44, 10.7%) and Siam (n=2, 0.5%). In addition, 265 (64.6%) of the respondents were married, 127 (31.0%) were single and 18 (4.4%) were divorced. Most of the respondents were lived in their own house (n=244, 59.5%) and 166 (40.5%) were lived in rented house. Meanwhile, most of the respondents 149 (36.3%) possessed Bachelor/Professional Certificate, followed by STPM/Diploma

(n=107, 26.1%), SPM (n=93, 22.7%), Master/PhD (n=43, 10.5%), SRP/PMR (n=12, 2.9%) and UPSR (n=6, 1.5%).

Table 5: Respondents' demographic

Respondent	Characteristic	Frequency (n)	Percent (%)		
ofile					
Gender	Male	171	41.7		
	Female	239	58.3 19.0		
Age	18-25	78			
	26-34	121	29.5		
	35-44	95	23.2		
	45-54	72	17.6		
	55-64	37	9.0		
	66 and above	7	1.7		
Races	Malay	311	75.9		
	Chinese	53	12.9		
	Indian	44	10.7		
	Others : Siam	2	0.5		
Marital status	Single	127	31.0		
	Married	265	64.6		
	Divorced	18	4.4		
House status	Rent	166	40.5		
	Own	244	59.5		
Education level	UPSR	6	1.5		
	SRP/PMR	12	2.9		
SPM		93	22.7		
STPM/Diploma		107	26.1		
Bachelor/Professional	Certificate	149	36.3		
Master/PhD		43	10.5		
Total		410	100.0		

After the reliability and validity of the measurement model have been established, the structural model was evaluated. Evaluation of structural model involved several assessments which were collinearity issues, coefficient of determination R^2 , effect size f^2 , predictive relevance Q^2 and path coefficient. The Variance Inflation Factor (VIF) of the present study was ranging from 1.170 to 2.195, which is below the threshold of 5.0 (Hair et al, 2014) indicate there is no collinearity issued present.

Table 6 shows the assessment result of structural model. The value of coefficient of determination $\rm R^2$ of intention was 0.518, indicate that 51.8% of the variance in intention can be explained by attitude, subjective norm, perceived behavioural control and perceived cost, thus categories as having moderate predictive accuracy (Hair et al., 2011). In addition, the $\rm f^2$ value of attitude, subjective norm and perceived cost were below than 0.15, which indicate small effect of intention on constructs, according to (Cohen, 1988). Meanwhile, intention has medium effect on perceived behavioural as the $\rm f^2$ value exceed 0.15. The predictive relevance $\rm Q^2$ of intention was 0.324, which exceed the threshold value of zero Hair et al.

(2014) indicate the exogenous constructs have good predictive relevance for the endogenous construct under consideration.

The result on Table 6 also shows that all hypotheses were supported as the path coefficient of each construct met threshold value of p < 0.05 and t > 1.96 (Hair et al., 2014). The result shows that there was significant relationship between attitude and intention to install solar PV with β = 0.156 at t value 3.311 (p < 0.005). This indicate that Malaysian household which has positive attitude possessed intention to install solar PV. The person who believed that installing solar PV gives many benefits and good effects to the environment will install solar PV through his intention. This finding was consistent with Abreu et al. (2019) and Sun et al. (2020), who observed attitude was influential in affecting the intention to install solar PV in US and Taiwan, respectively.

The subjective norm was found to have significant impact on intention to install solar PV as β = 0.210 at t value 3.584 (p < 0.005). This result has been echoed by Mutlu and Der (2017), who found that good recommendation and feedback from someone's social circle may encourage their intention to install solar PV. In the other word, Malaysian household are easily to be influence by their surrounding and therefore, more positive feedback of solar PV should be exposed in the Malaysian society to encourage adoption of solar PV.

In addition, perceived behavioural control was found to stimulate intention to install solar PV as β = 0.393 at t value 7.972 (p < 0.005), where this finding support Sun et al., (2020) and Aggarwal, Syed & Garg (2019), who stated that perceived behavioural control are critical determiner in influencing intention to install solar PV. In other words, Malaysian household who has control on their resources such as knowledge and money to purchase solar PV, will install solar PV through their impact upon their behavioural intention. Besides, the result also indicate that someone with strong believed in their capability to install solar PV was believed to influence their intention to install solar PV.

The result also indicate that perceived cost has significant influence on intention to install solar PV as (β =0.156, t=3.311, p<0.005). This bring a mean that Malaysian household perceive cost of solar PV as one the main factor to consider when it comes to adoption. Most of them agree that solar PV has a relatively high initial cost. Nevertheless, they still have intention to install solar PV in future. This study yield a different finding in term of perceived cost from previous past studies where previous studies such as Abdul Aziz et al (2017); Muhammad-Sukki et al (2011) claimed that consumers are not willing to purchase solar PV due to high installation cost. The higher the perceived cost, the lower the intention to install solar PV.

Table 6: Structural model result

		Path		β		S		t-		р	Resul		f		R		Q
					td		value	•	- valu	е	t	2		2		2	
		ATT	>	0		0.		3.		0	Supp		0				
1	INT		.156		047		311		.001		orted	.032					
		SN	>	0		0.		3.		0	Supp		0		0.		0.
2	INT		.210		059		584		.000		orted	.042		518		324	
		PBC	>	0		0.		7.		0	Supp		0				
3	INT		.393		049		972		.000		orted	.181					
		PC	>	0		0.		3.		0	Supp		0				
4	INT		.168		042		956		.000		orted	.050					

Conclusion

Generation of energy using fossil fuels are not sustainable as it will depleting very fast. Besides, generation of energy using fossil fuels also give bad impact to nations such as air pollution, global warming and oil spills which endanger marine life. Due to the issues above, Malaysian government have shift their energy mix to renewable energy such as solar energy. Since 2011, solar PV has been given much attention as it was seen as the most suitable and practical technology in generating energy from renewable energy sources, and due to the fact that Malaysia has a tropical rainforest climate that provides sunshine throughout the year. Looking at the potential of solar PV, the Malaysian government have introduced the FiT program with a duration of five years from 2011 – 2016 and the latest solar program is NEM program with the aims to encourage clean energy generation using solar PV.

However, despite the rapid growth of solar PV development in Malaysia, the adoption rate of solar PV is not consistent with the growth of solar PV market. The issues have raise questions on the factors that lead to the lack of involvement of the Malaysian community, especially households, in the NEM program. This research reveals that all the independent variables namely attitude, subjective norm and perceived behavioural control have a direct, positively significant impact on solar PV intention to install solar PV. This study also uncover an interesting findings where perceived costs have been proved to have direct, positively significant withintention to install solar PV. In other words, households perceived solar PV is a high cost product but their still have intention to install solar PV. This proved that perceived cost is not a barriers to the installation of solar PV. Meanwhile, other factors such as attitude, subjective norm and perceived behavioural control are believed to be a catalyst to the installation of solar PV if it is well stimulated.

For this reason, it is hoped that the result of this study will provide input to helps marketer in strategizing their marketing strategy to change consumer intention towards actual behavior. Solar PV marketers are encouraged to widespread the benefit of solar PV among the society through various medium such as social media and television. Moreover, this findings hopes will be an input to government policy maker to improve solar energy program particularly NEM program in future which will increase solar PV adoption among household in Malaysia. This study also contributes to the body of knowledge by adding new construct to TPB theory that are relevant to solar energy adoption. The authors have expand the original theoretical model of TPB by adding variable perceived cost to test either it is the barriers to the adopt solar PV among households in Malaysia.

There are several limitation in this study which are this study is conducted in Klang Valley only. Therefore, future researchers are advised to broaden their research sampling area across all states in Malaysia. Broaden the sampling area would yield a different and better result for the study. The future research are also suggested to carry out qualitative research to increase consistency and accuracy of the result.

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