

# Factors Affecting Energy-Efficient Household Products Buying Intention: Empirical Study

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**Abstract** – The aim of this study is to identify the factors affecting behavioural intention in buying energy-efficient household products in Malaysia. The extended Theory of Planned Behaviour (TPB) was tested in this research. Five hypotheses were tested using data derived from 336 residences in Malaysia. The hypothesized model incorporates knowledge and reasonable price into the conventional (TPB) model. Multiple regression analysis was used to examine the relationship between the independent and dependent variables. The results of the multiple regression analysis show that attitude, subjective norm, perceived behavioural control, knowledge and reasonable price have significant and positive effect on energy-efficient household product buying intention among residences in Malaysia. This research results provide insights for companies for promotion of green technological products and in strategizing to motivate residence in Malaysia to embrace green consumption behaviour.

**Keywords** – Cleaner product; Malaysia; residence; TPB

## 1. INTRODUCTION

Nowadays environmental issues and concerns are widely accepted and considered [1]. Due to the environmental degradation globally, consumers in all over the world have started to understand that their buying behaviour is the root of environmental problems [2]. According to Paco and Raposo [3], Barber [4] and Okada and Mais [5] consumers are now willing to change their behaviour in green context due to increasing awareness of health issues, global warming, climate change and environmental matters. Major changes are being required of energy infrastructure as it faces the serious challenges of protecting the climate, reducing pollution, and securing energy. Due to concern about climate change and energy security, companies are now producing environment-friendly products and started to use environmental strategies. Researcher identified that ecological product market demand steadily growing all over the world [6]. Thus, companies are introducing ecological products such as food and cars. Some other ecological products such as reusable and recycling packaging, energy saving bulbs and many other products that are capturing companies' attentions [7].

Consumers attitude have been changing towards acceptance of environmentally friendly products. Companies and academic researchers have realized the importance of environmental issues.

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According to Chen and Chai [8] Malaysian government has established some strategies to encourage and promote sustainable consumption practices to Malaysian consumers. In 24 July 2009 Malaysian government has introduced National Green Technology Policy for the Malaysian people [9]. There are four pillars namely Social, Environment, Economy and Energy. Green Technology is the main driver to speed up the national economy and promote sustainable development. Therefore, more attention has drawn to the corporate across in Malaysia on sustainable energy conservation.

The energy demand in Malaysia will increase 4.8 % by 2030 [10]. Malaysia is experiencing rapid economic growth due to the increased number of population, much higher investments in infrastructure development and massive growth of the construction industry. Thus, it is necessary to establish the demand side energy management. Considering the high demand for energy at individual homes, Leelakulthani [11] stressed that it is important to reduce the exhaustive usage of energy by implementing efficient energy production techniques and efficient energy consumption. Monthly home electricity bill will decrease if home energy management system is implemented and energy efficient product use at home is encouraged. Energy efficiency denotes lesser usage of energy in providing same services or functions.

According to Shila [12], business sectors and government of Malaysia have taken environmental issues seriously. Zainudin's [13] study shows that yearly 30 to 40 environmental services have emerged recently, whereas it was merely there a decade ago. Moisander [14] stated that eco-friendly consumption increased due to awareness of natural issue and environmental protection. There are few studies conducted in this area as it is one of the new issues in Malaysia [13]. Moreover, there is a need for closer examination of energy efficient product buying intention in a specific country. Due to social, economic and cultural differences research findings cannot be generalized and transferred from one country to another country. These arguments led us to conduct this empirical study, which examines household energy efficient electronic product buying behaviour by using extended Theory of Planned Behaviour Model [15]. In this study, Theory of Planned Behaviour (TPB) is used, because it provides the theoretical support and justification in interpreting the results. In addition, this model also identified the predictor variables for energy efficient product buying intention.

## 2. THEORETICAL FRAMEWORK

### 2.1. Theory of Planned Behaviour (TPB)

Human behaviour is explained in TPB model. TPB is used in various field of study such as healthcare, public relation and advertising to examine the relationship among behaviour, behavioural intention, attitudes and beliefs. TPB states that individual's behavioural intentions and behaviour is influence by attitude, subjective norms and perceived behavioural control [15]–[17]. According to Ajzen and Fishbein [16] the central theme of the TPB theory is that actor behaviour is under control which can be anticipated by examining individual's intention to perform certain behaviour. Ajzen [17] stated that intentions are individual motivation, enthusiastic to give effort and intent to work had to enact certain behaviour.

TPB is the extension of theory of reason action (TRA). To improve the predictive power of TRA perceived behavioural control variable added an additional variable. According to Robinson and Smith [18] TPB can assess and evaluate the human behaviour and traits. TRA also can use to test the adoption or rejection of human behavioural traits and reactions. In choosing or purchasing a product TRA has the capability to define attitude. On the other hand, TRA also explains and provides reason to selecting certain type of products by the consumer [19]. Other than two main constructs in TRA i.e. attitude to the behaviour and subjective norms, TPB compliments another variable perceived behavioural control [20].

## 2.2. Literature Review

TPB is one of the simple and competent frameworks which is used to examine the individual's intent to perform context-specific actions [21]. According to Taylor and Todd [22] and Ajzen [17] several social psychologies associated and empirical studies have been supported by TPB. A meta-analysis study conducted by Thomson et al. [23] found that 40–50 % of variance is explained by the measure of attitude, subjective norm and perceived behavioural control in intentions and 19 % and 38 % of variance explained by behavioural intention.

Researchers like Conner and Sparks [24] and Sparks and Shepherd [25] conducted studies on food choices behaviour of consumers using theory of planned behaviour (TPB). Using habit as an additional independent construct Armitage and Conner [20] conducted a study using TPB as a base model. In other food-related researches TPB is used as the base theory and found TPB is the important model [26], [27].

Cook et al. [28] and Sparks et al. [29] studies in food-related behaviour were used theory of planned behaviour (TPB) and confirmed TPB is the important model. In the last 20 years 600 empirical studies have concluded that TPB can be the important theory for any behavioural research. Bonne and Vermeir [30] study used habit as an additional variable with TPB model in halal meat consumption in France. This study confirmed that attitude, subjective norm and perceived behavioural control have significant effect on halal meat consumption.

TPB has been used as the model in other researches include the green product purchase behaviour [31], [32], organic food purchase behaviour [32]–[34], online buying behaviour [35], [36]. Information system researchers [37] and genetically modified food researchers [38] also used TPB in their studies.

Although researchers identified TPB is one of the most powerful models to predict individual behaviour (see review [39]) additional variables are included in many other researches such as knowledge [40] and reasonable price [41]. Ajzen [16] stresses that TPB is open to extend by adding further additional variables. This argument is allowed the researchers adding additional variables within extended TPB model context. Thus, knowledge and reasonable price variables are considered to be worthy in this research.

## 3. RESEARCH MODEL AND HYPOTHESIS

Fig. 1 is the research model developed for this study. The research model used in this study is shown in Fig. 1. Before actual purchase, purchasing intention of energy-efficient product preceded. It is assumed that attitude has a direct and positive relationship with behavioural intention. Subjective norms, behavioural control, knowledge and price were also hypothesized as having direct relationships with intention to buy.

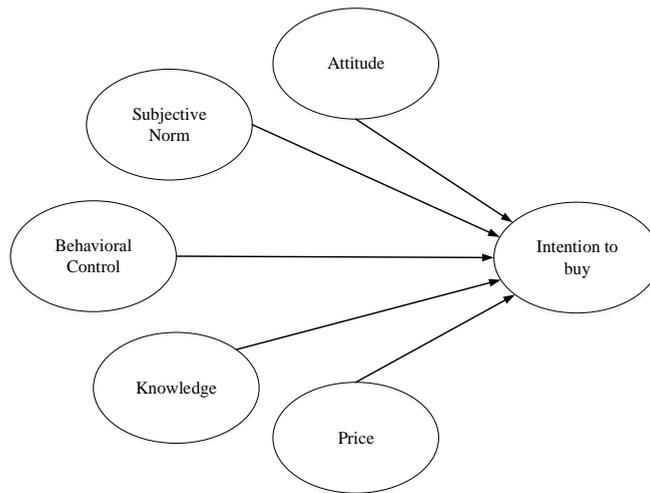


Fig. 1. Conceptual framework of this study.

Five hypotheses (stated below) were developed to test the relationship between dependent variable (purchasing intention of energy-efficient product) and independent variables (attitude, subjective norm, perceived control, knowledge and price). Previous literature supported the directionality in each hypothesis which is based on the TPB model [41]. Thus, this study intends to confirm the direct and positive relationship between attitude, subjective norm, perceived behavioural control, knowledge and price and behavioural intention.

### 3.1. Attitude

Attitude is one of the leading factors in shaping consumers purchase behaviours [42]. Residents with favourable attitude toward energy saving affect intention to buy energy efficient product. Numerous empirical studies confirmed that attitude is considered as an important factor of behavioural intention in various settings i.e. consume sustainable or environmentally friendly foods [43], sustainable food consumption [44]. In addition, some studies have found a particular relationship between attitude and electricity saving intention. Among them Zhang et al. [45] have found significant relationship between attitude and intention to save electricity. Therefore, the following hypothesis is developed:

**Hypothesis 1:** There is a significant and positive relationship between attitude and intention to purchase energy-efficient household products.

### 3.2. Subjective Norm

Subjective norm is considered as the second independent construct of intention in TPB model. According to Ajzen [16] subjective norm refers to “the perceived social pressure to perform or not to perform the behaviour”. Ajzen and Driver [46] reported that normative beliefs is the social factor and basis for subjective norm. Bagozzi et al. [47] called perceived social pressure as the subjective norm which comply with expectations about engaging in the behaviour.

Several other researchers have mentioned subjective norm as important factors of behavioural intention in marketing area and consumers research, such as green product buying behaviour [48], halal food buying intention [49], organic food buying intention [33], [34] and online buying intention [50]. All these studies found significant and positive relationship between subjective norm and

behavioural intention. This study also hypothesized significant and positive association between subjective norm and intention to purchase energy-efficient household product. For this context, we propose:

**Hypothesis 2:** There is a significant and positive relationship between subjective norm and intentions to purchase energy-efficient household products.

### **3.3. Perceived Behavioural Control**

Perceived behavioural control is the third most important determinants in TPB model. Researchers like Zhang et al. [51] studied in waste separation behaviour, Chang et al. [52], Teng et al. [53], studied in green hotels, Tarkiainen and Sundqvist [54], Thøgersen [55] studied in organic foods and Paul et al. [56] confirmed positive and significant association between perceived behavioural control and behavioural intention. Based on the above findings, we can say that consumer will purchase energy-efficient household product when they have enough control about the instant. In this research perceived behavioural control is considered as the ability to purchase energy-efficient product. The third hypothesis proposed here is:

**Hypothesis 3:** There is a positive and significant association between perceived behavioural control and intention to purchase energy-efficient household products.

### **3.4. Knowledge**

Knowledge has significant influence in all phases in the decision-making process [57]. Specifically, knowledge is a relevant and significant construct that affects how consumers gather and organize information [58], how much information is used in decision making [59] and how consumers evaluate products and services [60]. Young et al. [61] study presented environmental knowledge is one of major determinants of green purchase behaviour. Chan and Lau [62] studied in China and used ecological knowledge is one of the predictors in green purchase research. The study results show that the higher ecological knowledge has ultimately influence green purchase behaviour. Wahid et al. [2] and Mei et al. [63] conducted studies on green purchase behaviour using environmental knowledge as one of the predictors and found significant relationship between environmental knowledge and green purchase intention. Therefore, the hypothesis developed is:

**Hypothesis 4:** There is a positive and significant association between knowledge and intention to purchase energy-efficient household product.

### **3.5. Reasonable Price**

Researchers have found significant influence of price and green purchase intention [64]. Other researchers have confirmed that consumers with positive motive would purchase green if manufacturers offer reasonable price for green products [65], [66]. Environmental conscious consumers always buy green products although it is high price. Other studies argued that consumers are willing to pay high price for eco-labelled products [67], [68]. Zhen and Mansori [69] highlighted that consumers are always search for low price for green products when they, but high price for green products will reduce purchase intention. These results support to develop the following hypothesis:

**Hypothesis 5:** There is a positive and significant association between reasonable price and intention to purchase energy-efficient household products.

## **4. RESEARCH DESIGN**

The main objective of this study is to examine and analyse the factors that are influencing household intention to buy energy-efficient products. An empirical study was undertaken to accomplish the objective of this study. This section briefly explains the methodological matters

related to sample and procedure (section 4.1), measures used (section 4.2), reliability and validity of measures (section 4.3) and multicollinearity and normality of study data (section 4.4).

#### **4.1. Sample and Procedure**

Residents of Klang Valley in Malaysia were chosen as the sample for this study. Klang Valley consists of Putrajaya, Petaling jaya, Klang, Gombak, Sepang, Ulu Langat in Selangor state. Kuala Lumpur is the capital city and largest city of Malaysia. The main reason is chosen this area as it has the highest population density and urbanisation. Compared to other states in Malaysia it is also has the modern facilities and well equipped.

Initially to test the face validity, the questionnaire was pretested to the faculty members at Faculty of Economics and Management Universiti Kebangsaan Malaysia. On voluntary basis, five faculty members participated and provided constructive suggestions. The final questionnaire was fine-tuned based on the feedbacks given by the pretest samples. The revised questionnaire was then administered to respondents with a cover letter explaining the purpose of the study.

Due to cost and time saving non-probability convenience sampling method was used to in this study. Data was gathered face-to-face. Students from research methods class participated in the data collection process. First, they posted 1000 questionnaires including a cover letter to the respondents. After fifteen days, researcher personally contacted the residents and requested them to participate in the survey. Within one and half month a total of 345 completed questionnaires were received with a response rate of 34.5 %. Due to incomplete responses, 9 questionnaires were discarded. Only 336 questionnaires were used for this final analysis.

The highest contributors to the total respondents are represented by young female Malay (51.01 %), Chinese were 40 %, Indian 8.11 % and others 0.88 %. Most of the respondents are female (60.16 %) and most of the them were from the age group between 30–40. Most of the respondents are working full on a time basis (85.14 %). Majority of respondents received higher education (75.07 %), 16.23 % were diploma holder and 8.70 % were other educational background.

#### **4.2. Measures**

The measurement items of all constructs i.e. attitude, subjective norm, perceived behavioural control and behavioural intention were adopted and modified from the study of Alam and Sauyiti [49]. Reasonable price was adopted from the study of Suciarto et al. [70] and knowledge was adopted and modified from the study of Yang [71]. Likert type scale was used (1 = strongly disagree to 6 = strongly agree) in the questionnaire. All items of the constructs shown in Table 1.

#### **4.3. Reliability, Content Validity and Construct Validity**

Cronbach's Alpha value was used to verify the internal reliability of the items [72]. The Cronbach alpha value for perceived intention was 0.863 attitude is 0.891, following by subjective norms which was 0.772, perceived behavioural control was 0.824, knowledge was 0.759, and reasonable price was 0.823. The alpha values for all the constructs are above 0.7 which indicates a reliable consistency among the variables [72].

The questionnaire is developed based on extensive literature review and opinion of experts on the area of study. As suggested by Nunnally [72], content validity represents the adequacy of specific domain of content and comprehensive measure of area under study. The items were adopted and adapted from established literature survey that so that the approach should support the issue of content validity.

Construct validity was tested through exploratory factor analysis (EFA). The EFA test enable the identification of underlying constructs and investigation of relationship between key survey interval-

scale of questions which in the case of this study is about intent to buy energy-efficient electronic products. In doing so, factoring of principal axis was carried out which continued with varimax rotation (Kaiser-Normalization) to facilitate interpretability. Sampling adequacy were tested using Kaiser-Mayer Olkin measures to determine the suitability of using factor analysis. Only factors that hold eigenvalues of more than 1.0 should be retained and below that to be dropped. The test yielded a total of 5 factors with eigenvalue of more than 1.0 explaining 59.32 % of the total variance. The combined results of factors analysis on five conditions for energy efficient product buying intention was considered in this study indicating all items loaded on their expected factors (Table 1).

TABLE 1. FACTOR ANALYSIS AND RELIABILITY

<b>Attitude</b>		0.891
I like the idea of buying energy efficient household products	0.654	
I think that buying energy efficient household product is a good idea	0.712	
I have favourable attitude toward energy efficient household products	0.687	
<b>Subjective Norm</b>		0.772
People who influence my behaviour would think that I should buy energy efficient household products	0.725	
My close friends think that I should buy energy efficient household products	0.670	
Most of the people who are important to me think I should buy energy efficient household products	0.734	
<b>Perceived Behavioural Control</b>		0.824
I will buy energy efficient household products even my friends advise me not to use	0.679	
Buying energy efficient household products is entirely within my control	0.652	
I have resources and ability to buy energy efficient household products	0.698	
<b>Knowledge</b>		0.759
I have sufficient knowledge about energy efficient product	0.625	
I have knowledge about energy efficient product is based on previous experience	0.761	
I have a positive impression about energy efficient product	0.693	
<b>Reasonable Price</b>		0.823
The price for energy efficient household products impulse me to buy	0.683	
The price for energy efficient household product is too high for me to buy ®	0.691	
I think low price is for buying energy efficient household products		
The price of energy efficient household products are affordable to buy for me	0.726	
<b>Buying Intention</b>		0.863
I intend to buy energy efficient household products	0.867	
I intend to buy energy efficient household products regularly in future	0.876	
I would highly recommend buy energy efficient household products for other people to use	0.868	

#### 4.4. Normality of Data and Multi-Collinearity

Central Theorem is applied in this study based on the large sample (336 samples) therefore the issues of data normality is mitigated. In addition, two major methods; a) Tolerance test, and b) Variance Inflation Factor (VIF) were utilized in determining the multicollinearity between independents variables in this study [74]. In the Table 2 shown that: a) tolerance values are not less than 0.1 and b) VIF values are less than 10. Based on the results it can be conclude that

multicollinearity is not the problem in this study. The value between 1.5 and 2.5 is considered as the acceptable for Durbin-Watson range. Regression results show that the Durbin-Watson value is 1.917 which confirmed there is no auto correlation problems in our data which has used in this study. Thus, it can be concluded that multicollinearity is not an issue.

TABLE 2. TEST OF COLLINEARITY

Variables	Tolerance	VIF
Attitude	0.702	1.424
Subjective norm	0.723	1.323
Perceived behavioural control	0.780	1.283
Knowledge	0.792	1.541
Reasonable Price	0.735	1.436

## 5. HYPOTHESIS TESTING

In Table 3 multiple regression results show the strength of proposed hypothetical relationships. Based on the guidelines by Hair et al. [73] hypotheses were tested using a multiple regression analysis, where energy-efficient household products buying intention was the dependent variable. The analysis results found is shown in Table 3. The research results show that in the prediction model all hypotheses were found to be positive and significant. The results provide support for hypotheses H1, H2, H3, H4 and H5 where the following were observed: relationship between attitude and purchase intention ( $\beta = 0.371$ ;  $p < 0.001$ ), subjective norm on energy-efficient product purchasing intention ( $\beta = 0.371$ ;  $p < 0.001$ ), perceived behavioural control on energy-efficient product ( $\beta = 0.411$ ;  $p$ -value  $< 0.001$ ), knowledge on energy-efficient product purchasing intention ( $\beta = 0.486$ ;  $p$ -value  $< 0.001$ ) and reasonable price on energy-efficient product buying intention ( $\beta = 0.468$ ;  $p$ -value  $< 0.001$ ).

TABLE 3. REGRESSION RESULTS (DEPENDENT VARIABLE: ENERGY-EFFICIENT HOUSEHOLD PRODUCT BUYING INTENTION,  $p < 0.01$ )

Variables	Beta	<i>t</i> -value	<i>p</i> -value
Attitude	0.371	3.955	0.000***
Subjective norm	0.371	3.960	0.000***
Perceived behavioural control	0.411	4.469	0.000***
Knowledge	0.486	5.498	0.000***
Reasonable price	0.468	5.241	0.000***

\*\*\* $p < 0.001$

Extended TPB model was examined in this research, in which environmental knowledge and reasonable price were the two additionally variables introduced. The main objective of this study was to investigate Malaysian consumers' energy-efficient product buying intention. The results of this study suggested that consumers' buying intention of energy-efficient product can be predicted by TPB factors (attitude, subjective norm, perceive control), environmental knowledge and reasonable price.

Consistent with previous studies, this study confirms the positive and significant association between attitude and energy-efficient product buying intention. Previous studies highlighted that attitude has significant effect and play important role on consumer's buying intention [75]. Another study also confirmed that attitude has positive relationship between behavioural intentions in different cultures [76]. Due to the high social pressure favourable attitude on buying intention of energy-efficient product was found in this study.

Support from previous study by Karajin et al. [77], this research also confirms that subjective norm has significant and positive associations with intention to purchase energy-efficient product in Malaysia. Other researcher also supported that subjective norm one of the important predictors of purchase intentions [78]. In Western culture people are individualistic and they think they are independent and autonomous, in which behavioural decision is affected by independent decision. Whereas, in Muslim culture in Malaysia, people tend to behave as a group and interdependent. This holds true for a collectivistic country like Malaysia.

According to Ajzen [17], in TPB model, perceived behavioural control has a direct relationship on behavioural intention. This study found a positive and significant relationship between perceived behavioural control and energy-efficient product buying intention. Previous studies have concluded similar findings [79].

Notably, examination of the relative strengths of the associations between the individual independent variables and energy-efficient household product purchase intention noticeably indicate that knowledge and reasonable price can explain the variation in energy-efficient household products purchasing intention [2], [63], [68]. In other words, those using energy-efficient household products, the perception of knowledge and reasonable price are the better predictors relating to energy-efficient product purchase intention.

## **6. CONCLUSIONS**

This research result highlights some implications that may help in formulating strategies for energy-efficient products production and customers' buying intentions. Attitude, subjective norm, perceived behavioural control, environmental knowledge and reasonable price had significant effect on buying intention with environmental knowledge having a strongest influence, followed by reasonable price, perceived behavioural control, subjective norm and finally attitude. Due to environmental issues and price, Malaysian consumers' have given full attention towards energy-efficient products. So it can be implied that, consumers in Malaysia are more concerned about the environmental degradation and cost of energy. If quality and performance of energy-efficient products are good, more consumer will purchase energy-efficient products. This study results also confirmed that consumers may decide to buy energy-efficient product because it will reduce energy cost and good for their health. Finally, it can also be concluded that Malaysians are motivated to behave environmentally friendly.

It is evident that in future energy-efficient household products will have higher demand and growth potential. Which means that energy-efficient product certification is important in Malaysia. This could lead to a growth in demand for energy-efficient certification. Hence, it could be suggested that and independent body should be established to audit energy-efficient products. The independent body can assist consumers in verifying the environmental claims, manage energy-efficient household products label and perhaps audit the energy-efficient household products procedures to ensure that these products meet acceptable quality standards.

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