

Extended Theory of Planned Behaviour: Electrical Energy Saving at Workplace

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Abstract

The use of electricity is one of the main sources in a path to create a conducive environment for learning and residential among students. A comprehensive management of electricity consumption is needed in order to address the issue of increasing energy consumption and a rising rate for the electricity bill in the commercial sector. Following the issues presented, this study was conducted to identify the behaviour of KKKL residents towards the use of electricity by using the Extended Theory of Planned Behaviour (ETPB) as a framework. The needed data were then collected through set of questionnaires that had been developed based on the Theory of Planned Behaviour (TPB). A total of 134 KKKL residents has been selected as respondents for this study. The researcher had opted to use random sampling method in the process of selecting respondents for this study and the data collected were then analyzed using Statistical Package for Social Science (SPSS) software version 23.0. From the descriptive analysis, it is found that the behaviour of the KKKL population as a whole was at a high level with a total mean of 4.51. It also shows that there is a relationship between behaviour and energy saving intention with the recorded value of $r=0.784$ and $p<0.05$. In the meantime, based on the regression analysis, it is found that subjective norms do not show any effect on energy saving intention while Attitude towards Energy Saving, Perceived Behaviour Control, Personal Moral Norm and Descriptive Norm showed an effect on energy saving intention with each beta value recorded were $\beta = .156$, $p < .05$; $\beta = .232$, $p < .05$; $\beta = .168$, $p < .05$ and $\beta = .476$, $p < .05$. This finding further illustrates that the increase in electricity bills is not due to the behavioural factors of the KKKL population based on the mean score obtained for the overall behaviour construct. This may be due to other factors that are not being addressed in this study such as the use of the building materials which had a potential to contribute in the increase of electricity consumption, such as the use of materials that required high heat storage and the use of obsolete and impractical electrical appliances.

Keywords: electrical energy, energy saving, theory of planned behaviour

1.0 Introduction

For human civilization, the use of energy resources is a necessity in order to carry out daily activities. In reality, the increase in the electricity consumption is directly proportional to the living costs and thus affect the environment. Studies on the Life-Cycle Assessment (LCA) show that the highest rates of carbon emission for electrical appliances are during the use of those appliances. This means that it is directly related to the amount of electricity or energy consumed by those equipment (Persatuan Penyelidikan Air dan Tenaga Malaysia, 2012). In educational institutions, particularly, the

use of electricity is the main key in creating a conducive environment for learning and residential for the student. Lighting can enable classes to be taught early in the morning or late at night. Electricity access facilitates the introduction of ICTs into the classroom such as computers and televisions (Sovacool & Vera, 2014). A comprehensive management of electricity consumption is needed in order to address the issue of rising rates in electricity bill for the commercial sector and the increase in the use of energy. Therefore, various studies have been carried out to ensure that the use of energy efficiently can save electricity costs.

1.1 Research background

Kolej Komuniti Kuala Langat (KKKL) is one of the public higher institutions that offered six full-time courses in which all of them has been accredited. These courses are offered to all high school graduates before they choose to enter the work market or by pursuing higher education. In addition, the college also offered short courses to the local community who are interested in exploring and improving their knowledge and skills in certain areas. The KKKL has a total of six academic blocks which fully operates by using electricity. The average electricity consumption is 9 hours a day on weekdays, which includes the use of electrical appliances such as lamps, fans, computers, air conditioning, water filters and many more. Therefore, the electricity required for the whole operation, including teaching and research activities, support services, and hostel residential areas are high. Electricity consumption is closely related to the consumer itself.

A study by Zulhairi (2014) found that resident behaviour is a non-technical factor that lead to a high electricity consumption. This is in line with the study conducted by Li, Xu, Chen & Menassa (2019) which stated that behaviour is one of the contributing factor in the increased of electricity consumption other than the motivation and ability factors. On the other hand, a study by Rabeah (2018) found that the use of building materials such as concrete blocks and concrete slabs also contributed to the increase of electricity consumption as these materials store a large amounts of heat. This suggests that there are other factors contributing to the increased of electricity consumption aside from the consumer behaviour.

1.2 Problem statement

The uncontrolled used of electricity has contributed to the increase in the KKKL's electricity bills back in 2018. According to the finance report released by the KKKL Finance and Account Management Committee (Jawatankuasa Pengurusan Kewangan dan Akaun, JPKA KKKL), there is an increase in the KKKL's electricity bills for a total of RM24, 834.87 (6.3%) compared to 2017. This situation should not occur since saving electricity practices has been enforced in the KKKL back in 2016. Hence, studies need to be conducted in order to identify the factor that led to the increase of KKKL's electricity bills.

1.3 Research purpose

An increase in the electricity costs is not a good indicator in an organization management. These problems need to be addressed as it can avoid wasting energy and money. Thus, this study was conducted to prove that these situations really existed and additional steps to save electricity can

be identified to further improve the practice of saving electricity among the KKKL residents.

1.4 Research limitations

This study focused on the daily electricity consumption activities at the KKKL. However, this study is not focusing on the usage rate of each electrical device at KKKL or work schedules, class schedules, student activities and even the design of the building due to the time constraints and costs needed in order to conduct an in-depth study. Additionally, this study focuses on the behaviour which include the attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, descriptive norm, and energy saving intention.

2.0 Research objectives

This study was conducted to achieve the following objectives:

- a. Identify the behaviour of saving energy among KKKL residents based on the attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, and descriptive norm.
- b. Identify the relationship between energy saving behaviour and energy saving intention.
- c. Identify the effect of electricity saving behaviour on energy saving intention.

3.0 Research questions

- a. What is the level of electricity saving behaviour among KKKL residents based on the attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, and descriptive norm?
- b. Is there a relationship between behaviour and energy saving intention?
- c. Is there a behavioural impact on energy saving intention?

4.0 Literature review

This study was conducted by referring to the Extended Theory of Planned Behaviour (ETPB) and Theory of Planned Behaviour (TPB). TPB emphasizes on the cognitive self-control as an important aspect of one's behaviour (Ajzen,1991). Intention is a key factor in the TPB. In TPB, the intentions are described as motivational factors that influence one's behaviour (Ajzen, 1991). Ajzen (1991) also describes intentions as a measure of one's willingness to try and their efforts in providing and demonstrating a good behaviour. However, a person's behaviour also depends on non-motivational actors such as times, finances, attitude, and external support. Thus, behavioural achievement depends on the combination of motivation (intention) and ability (control behaviour / perceived behavioural control) (Ajzen, 1991). Controlled behaviour is a self-confidence in achieving a better behaviour.

In accordance to TPB, behavioural control affects one's intentions and actions. Ajzen (1991) stated that from previous studies there are three situations for TPB applications, namely; i) only attitudes have a significant impact on the intention ; or ii) the attitude and control behaviour are sufficient to reflect the intention; and iii) in other situations, all three contribute to the intention. Hence, all three factors can influence one's intention in making changes. The theory can be simplified as shown in Figure 1.

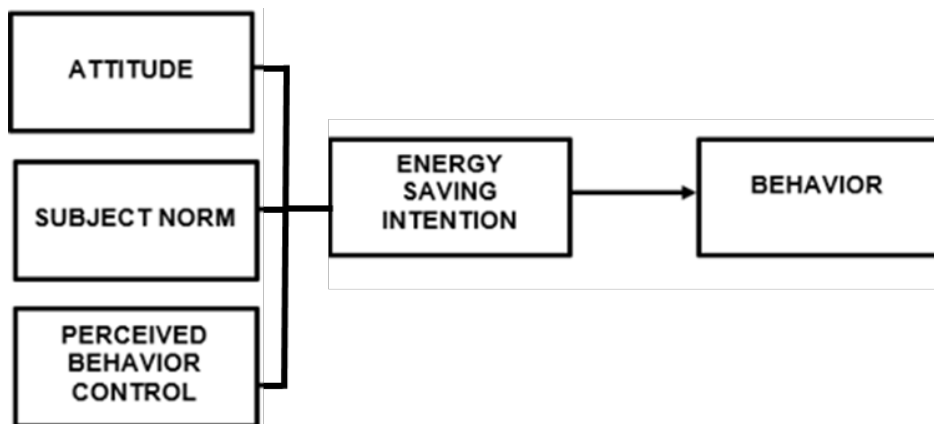


Figure 1: TPB by Azjen, 1991

The theory was extended to ETPB by Gao, Wang, Li, & Li (2017) and Nie, Fan, Xu, Fan, & Xu (2019). The influence of human behaviour was emphasized with personal moral norm and descriptive norm. This study adapted the ETPB as the conceptual framework as shown in Figure 2.

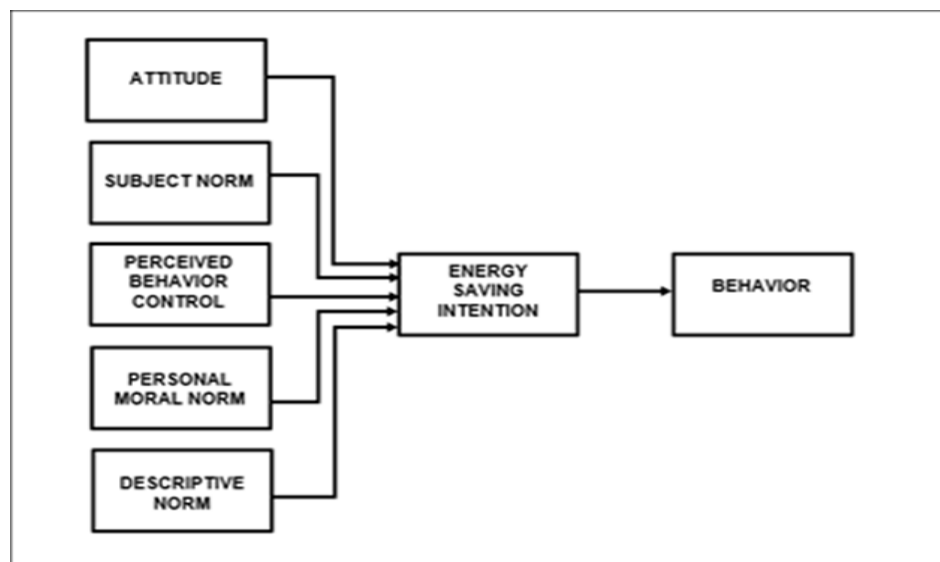


Figure 2: Research conceptual framework based on ETPB

In addition, there are a number of studies on behaviour that also examine personal moral norms and descriptive norms that are expected to influence the intention, namely studies by Gao, Wang, Li, & Li (2017) and Nie, Fan, Xu, Fan, & Xu (2019). Therefore, this study also focused on these two factors.

5.0 Research methodology

The researcher had opted to use a quantitative approach through survey method. This survey is intended to explain the current phenomenon. Furthermore, it was also chosen to quantitatively measure the relationship between the dependent variables and independent variables. This study was conducted based on the Extended Theory of Planned Behaviour (ETPB) framework and the data for this study was then collected through questionnaires that has been developed from the Theory of Planned Behaviour (TPB). The questionnaire was then randomly distributed to KKKL residents. The number of questionnaires that has been returned back for analysis was 134. The following data were then analysed using the Statistical Package for the Social Science (SPSS) software Version 23. In order to achieve the objectives outlined in this study, a descriptive analysis was used to answer the question related to the behaviour of KKKL residents in which it's consist of 5 sub constructs namely the attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, and descriptive norm. Apart from that, inference analysis, which is correlation and multiple regression has been used to determine the relationship and influence between behaviour and energy saving intention among the KKKL community.

6.0 Research findings and discussion

Descriptive analysis helped to provide the frequency and percentage regarding the respondents' background as well as the mean score and standard deviation of each variable. Descriptive statistics are used for the purpose of describing a large amount of raw data through a compilation for a better understanding. Mean is the average value which representing the data set because it's taken into account all the scores in the data set from the questionnaire. Table 1 shows the interpretation of the mean scores used in this study based on the five-point Likert scale in which has been divided into four stages in accordance to Nunally (1978) and Mohd Majid (2005)

Table 1: Interpretation of the Mean Scores

Mean Values	Level of Evaluation
1.00 – 2.00	Low
2.01 – 3.00	Intermediate Low
3.01 – 4.00	Intermediate High
4.01 – 5.00	High

Question 1

What is the level of electricity saving behaviour among KKKL residents based on the attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, and descriptive norm?

Descriptive analysis shows that the average mean for the behaviour construct is at a high level with an overall mean value of $M=4.51$, $SD=0.459$. This

suggests that KKKL residents have been practicing their behaviour towards high energy saving. Table 2 shows the mean score of each item for energy saving practices.

Table 2: Mean Score and the Interpretation of the Mean Score for Behaviour

Item	Statement	Mean	Standard Deviation	Interpretation
Attitude Towards Energy Saving				
1	Saving electricity at workplace is useful in protecting the environment	4.73	0.590	High
2	Saving electricity at workplace is essential in reducing carbon dioxide emissions	4.57	0.730	High
3	Saving electricity at workplace is very crucial in the effort to address the issue of energy shortage.	4.70	0.560	High
4	Saving electricity at workplace is wise move	4.88	0.460	High
Subjective Norm				
5	My colleagues at workplace thinks that I need to start saving electricity.	4.50	0.802	High
6	The head of unit/program thinks that I need to save electricity at work.	4.56	0.761	High
7	The higher management ordered me to save electricity at work	4.56	0.761	High
8	People around me think that I should save electricity at work.	4.58	0.788	High
Perceived Behavioural Control				
9	I can save electricity when at workplace.	4.54	0.801	High
10	I have the knowledge and skills to save energy at workplace.	4.56	0.643	High
11	Whether to save electricity or not, it's entirely depends on my will.	4.36	0.760	High

Personal Moral Norm				
12	I have a responsibility to save electricity at work.	4.25	1.009	High
13	Saving electricity at works depends on my obligations.	4.70	0.521	High
14	I would be unhappy if I did not save electricity at the workplace.	4.45	0.752	High
15	It is against my moral principle if I wasted electricity at workplace.	4.40	0.715	High
Descriptive Norm				
16	My colleague has taken an action to save electricity when at workplace.	4.42	0.739	High
17	Some of the staff at my workplace know that I have participated in the behaviour conduct (effort) to save energy.	4.15	0.954	High
18	The higher management had also participated in the saving electricity behaviour.	4.25	0.836	High
19	People around me have taken part in electricity saving behaviours.	4.45	0.721	High
Overall for the construct of behaviour		4.51	0.459	High

From the findings, it shows that the KKKL residents are adopting a positive attitude towards optimum electricity energy savings. The positive attitudes towards optimum electricity energy savings that was measured are attitude towards energy saving, subjective norm, perceived behavioural control, personal moral norm, and descriptive norm.

Question 2

Is there a link or relationship between behaviour and energy saving behaviour?

Correlation analysis had been used to describe the strength and direction of a linear relationship between the two variables (Pallant, 2013). The strength of the relationship can be interpreted based on the value of the correlation obtained. Table 3 shows the Pearson Correlation Interpretation that has been used in this study based on (Chua, 2009).

Table 3: Levels of Correlation Coefficient Strength

Correlation Coefficient Size (r)	Correlation Strength
0.91 to 1.00 or -0.91 to -1.00	Very Strong
0.71 to 0.90 or -0.71 to -0.90	Strong
0.51 to 0.70 or -0.51 to -0.70	Moderate
0.31 to 0.50 or -0.31 to -0.50	Weak
0.01 to 0.30 or -0.01 to -0.30	Very weak
0.00	No correlation

The strength of the relationship can be interpreted based on the value of the correlation obtained in Table 4. The results showed that there was a significant and strong relationship between behaviour and energy saving intention with a value of $r = 0.784$, $p < 0.05$. This strong and positive relationship indicates that the better the behaviour, the more the intention will increase (Chua, 2009).

Table 4: Relationship between Behaviour and Intention

Variables	Mean	Standard Deviation	r	p	Relationship Strength
Behaviour	4.50	0.459	0.784**	.000	Strong
Intention	4.52	0.513			

** Correlation significant at level 0.01 (2-tailed)

Question 3

Is there a behavioural impact on energy saving intention?

Regression analysis is used to determine or estimate the effect of one variable had towards another variable. Table 5 shows the effect predictor (independent) variables on criterion (dependent) variables according to (Cohen, 1988).

Table 5: Size of the Effect Predictor Variables towards Dependent Variables

Coefficient	Value	Size of the Effect
β	Below .05	Small in size and is meaningless
	.05 to .30	Small
	.31 to .50	Medium
	Exceeded .50	Large
R^2	Below .02	Small in size and is meaningless
	.02 to .15	Small
	.16 to .30	Medium
	Exceeded .30	Large

Table 6 shows the regression relationship between the attitude towards energy saving, subjective norm, perceived behavioural control, and descriptive norm with energy saving intention.

Table 6: The Influence between Attitude towards Energy Saving, Subjective Norm, Perceived Behavioural Control, Personal Moral Norm and Descriptive Norm with Energy Saving Intention.

Sub Construct	Standardized Coefficients	
	Beta	Sig.
Attitude Towards Energy Saving	.156	.016
Subjective Norm	-.030	.681
Perceived Behaviour Control	.232	.006
Personal Moral Norm	.168	.017
Descriptive Norm	.476	.000

Data analysis showed that only one subset of predictors did not influence the intention which is subjective norm sub construct. Sub constructs for other behaviours showed a significant influence over intention with a beta value for attitude towards energy saving, $\beta = .156$, $p < .05$; perceived behaviour control, $\beta = .232$, $p < .05$; personal moral norm $\beta = .168$, $p < .05$ and descriptive norm $\beta = .476$, $p < .05$). This is in line with the findings made by Gao et al. (2017) which suggested that subjective norms had no effect towards the intention while descriptive norms were the strongest in predicting intentions of saving electricity. In addition, there are other studies that have obtained similar results such as Muhammad Kashif, Zarkada, & Thurasamy (2018); Zhao, Zhang, & Xu, (2019) and Gao, Wang, Li, & Li, (2017).

7.0 Conclusions

Based on the mean score obtained for the overall behaviour construct, it has shown that the increase in electricity bills at KKKL is not due to the residents behavioural factors. This may be due to other factors that are not being addressed in this study such as the use of the building materials which had a potential to contribute in the increase of electricity consumption such as the use of materials that required high heat storage and the use of obsolete and impractical electrical appliances.

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