Energy Saving Patterns of Personnel Behaviour in Malaysian Office

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Abstract – *This research concentrates on determining energy saving patterns that appear in the behavior of staff in Malaysian office buildings, and the variables that affect their behavior. There are two types of variables to be studied, including personalities and environmental factors. Johor Bahru's office buildings, Malaysia' workers have been chosen as a source of data for qualitative study. Additionally, descriptive analysis and binary logistic regression have been selected as means for further analyzing inputs, in order to accomplish the research objectives. The result indicates that there are two types of energy saving patterns, specifically Saver and Non-Saver. Based on the results, gender, age, education, income and personal characteristics have all been identified as factors that impact energy saving patterns. In terms of the environmental variable, it has been shown that environmental concern, environmental knowledge, perceived consumer effectiveness, resource saving and income, are all major factors that affect energy-saving behaviors. The outcome of this study is crucial for facility management, in obtaining information related to personnel behavior, and adds to the possibility of improving energy saving and conservation in the workplace.*

Keywords – *behavior, energy saving, office building, pattern, personnel.*

1. INTRODUCTION

In Malaysia, future energy consumption is predicted to increase, alongside energy demand [1]. This leads to carbon dioxide (CO_2) emission and global warming [2]. Electrical saving is also essentially important in Malaysian office buildings. In accordance with the outcomes of this study's literature review, the following research analysis and achievement of research objectives has focused on personalities and environmental variables. The outcome is vital, and has the potential to help facilities management to manage energy during future building operations.

However, since electricity generation is a primary contributor to CO_2 increases, energy in buildings is a complicated issue because it relates to every aspect of a building. Personnel behaviour has an essential role to play in saving energy in buildings [3]. Most past theories and models related to energy saving have focused on the residential sector, and therefore research only centred on household behaviour and behavioural changes that can be made by households, in changing their way of life [4], [5]. There are many types of individuals with various types of behaviour, who use office buildings within the commercial sector. Therefore, this results in when seeking to analyse personnel behaviour.

Energy consumption in Malaysia has been seen a dramatic increase in recent years, particularly in commercial and residential buildings. The demand for energy was growing rapidly in developed countries to obtain a higher standard living. In Malaysia, buildings consumed about 48% of total electricity generated.

Nowadays, people in develop countries always spend 80-90% of their time at indoor for more comfortable especially for commercial and residential buildings [6]. Commercial buildings were a good place to look for searching the energy saving opportunities. Based on the data from Malaysia Energy Information Hub, the energy consumption by commercial sector is increasing rapidly from 2000 to 2014. The types of commercial buildings have included education, health care, office building, religious worship and others. From these types of commercial building, the office building had taken to focus for this research because the importance of electrical energy is no exception for Malaysian office building.

This paper aims to answer two questions, including (1) how can energy saving patterns be identified from personnel behaviour in Malaysian office buildings, and (2) what variables affect the energy saving behaviours of employees?. The aim of this paper is to identify energy saving patterns in personnel behaviour within Malaysian office buildings, and to analyse variables that affect the energy saving behaviours of employees. The scope of this study has concentrated on an office building in Johor Bahru, Malaysia. The employees' behaviours, when using electric energy, have been utilised in order to determine their energy saving patterns. To evaluate energy saving behaviour patterns, the energy saving pattern benchmark index developed by [7] has been utilised. This paper's research selected personalities and environmental variables that have been determined to affect energy saving patterns. The energy saving of Malaysian office buildings was important as the increase in electricity consumption of office building contributed the high release of greenhouse gases. Many researchers had conducted about the variables which can influence the energy saving. However, the researchers were more depend on the residential household and rarely referred to a commercial office building. This research emphasised the energy saving pattern by behaviour in

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Malaysia office building to help facilities manager get the awareness for employees' behaviour that influences the energy saving patterns. Considering our specific topic about interventions and energy-saving behaviour, an integrated energy-saving behaviour model was required. However, as we believe that people are different, interventions aimed at residential energy-saving may have different influences for different people. Energy consumptions can be minimised by residential occupants if energy usage was considered by their behaviours [6]. Nonetheless, it was challenged to the category of the behaviour pattern towards saver or non-saver from various variables because of their

employees' behaviour. Figure 1 had shown the Electricity Consumption Malaysia by Commercial Sector in 2000 to 2014 was increased continuously. This occurred because of the less awareness of energy saving by the commercial sector. Many theories and models about the energy saving had studied before this, but most of them were focused residential sector. Because of the residential sector, by changing the lifestyle, the research just focused on the household behaviour and the behaviour that can change by the household themselves. In the commercial sector, the office building included many types of people and they came from different behaviour.
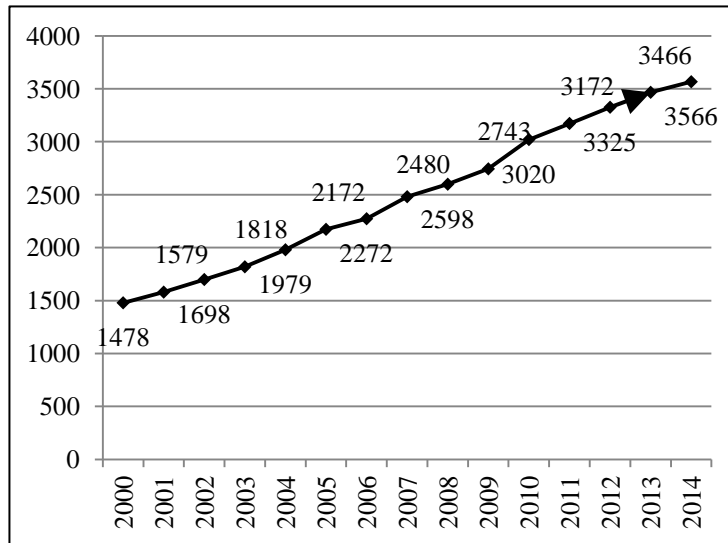

Fig. 1. Electricity consumption (ktoe) by Malaysian commercial sector from 2000 to 2014 derived from the Malaysia Energy Information Hub.
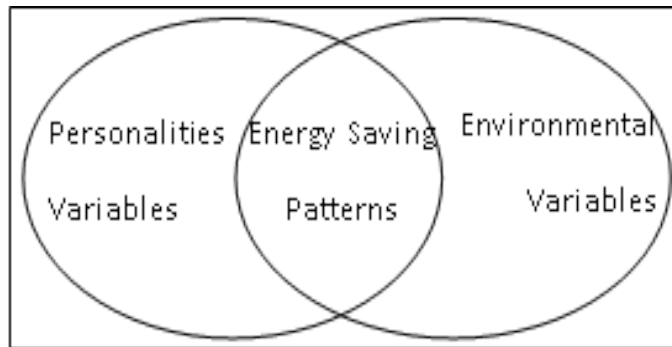

Fig. 2. The research's theoretical framework.

2.   LITERATURE REVIEW

Within the following literature review, a number of past pieces of research have been studied in order to explore energy-related behavior, such as that related to energy efficiency, energy consumption, energy saving and energy conservation. The research objectives can be achieved, with the support of information gathered through the literature review. This study has applied various related models and theories as identified in the literature. Figure 2 presents the research's theoretical framework.

2.1   Building Design

Design factors that affect the building's energy consumption rate are the size and shape; orientation; planning and layout; thermophysical properties; window systems and construction detailing [8]. The building design had a predetermined room temperature, outside brightness, the altitude and intensity of the sun, the positioning of windows and the time will affect the energy consumption by tenants. Unsuitable housing design for tropical climate has increased the indoor temperature, leading to more frequent in using electric fans or HVAC system. In generally, the orientation of building affected the cooling and heating system of that

building because of the natural ventilation. According to [8], the building wall facing perpendicular to the north-south axis has a higher indoor temperature compared to the building wall facing perpendicular to the east-west axis which is due to the thermal effect in the building. The building and organisation itself can cause the energy saving pattern of employees. The national policy is not perfect, the insufficient of building design, the energy consumption monitoring platform and the supervision system of large scale building is not perfect, and the last is a shortage of energy saving management had affected the energy consumption in the building become non-carer [9]. Electricity use in China large office buildings is the lighting consumes and influenced by occupant behaviour in the building. For the outdoor of the building, that is because of lack of automotive daylighting control. Larger office buildings have higher energy use intensity than smaller buildings due to higher occupancy levels and higher plug loads. [10] had found out the two main factors affect the lighting energy use had shown in a study, which are outdoor luminance and occupant behaviour. The research done by [11] shown that small office building has a low energy consumption rate compared to large office buildings, this is because a large building requires more energy compared to the smaller building for its cooling or heating purposes. A higher energy consumption rate is caused by the heights of a ceiling and space volume to cooled or heated [12]. The size of dwelling in the term of floor area is an important parameter affects the annual energy consumption. It is notable that energy consumption in semi-detached and the apartment is not any big change between summer and winter demand but in detached and terraced houses demand in winter is three times more than summer time. Window design is decisive in providing an appropriate visual comfort for occupants and sufficient energy savings in electric lighting [13]. To assess the influence of outdoor luminance on the lighting energy use, the basement floor and the above-ground floors were compared. The layouts of offices on the above-ground and basement floors were generally similar, but the offices in the basement had no access to outdoor light because there was no daylighting controls or any other automatic lighting controls such as occupancy sensors in building. Thus, basement floors cause the electric lighting energy used more than basement floors. The material properties affecting the rate of heat transfer in and out of a building. Reference [14] show that the room built with high thermal resistance walls consumes lower energy compared to low thermal resistance wall. The importance of construction detailing in controlling or reduce the thermal transition to the building. The infiltration of cold air losses at the junctions of different materials especially between roof joists and exterior walls is similar to the effect of leaving the door open in an air conditioned room.

2.1.1 *Personality variables*

A research had reported that the research conducted on buildings in respect to energy saving are uncertain and ineffective because of behaviours of the occupants [15].

There are humidity, temperature, air ventilation and noise.A method of formulating energy load profile for domestic buildings in the UK by [16] stated that the use pattern varies depending on the different factors, such as climate, household composition, family income, culture background, and human factor. In order to produce domestic load profile with taking into account various factors, a cluster analysis method has been applied. Even with the same building size, design, and space heating systems, different residents have different energy demands. In this study's framework, personality is considered to be a pattern of relatively-permanent traits and unique characteristics that give both consistency and individuality to a person's behaviour [17].

Hence, the focus of this research is on demography and personal characteristics, serving to study variables that affect patterns of energy saving behaviours. These include:
 a) Demography variables (gender, age, education, and income);
 b) Personal characteristics (openness, conscientiousness, extraversion, agreeableness, and neuroticism).

2.1.2 *Environmental variables*

According to behaviourists, personality is behaviour, and that behaviour is moulded for the most part by people's engagement with the environment. Behaviourists do not incorporate the mind, by any means. The experience of every individual in his or her situation, will impact the individual's attitude, and lead to them acting in a specific way. For example, if a youngster has unpleasant encounters with animals, then they may develop an uneasiness with animals later in life. Likewise, an individual who is 25 years old, has completely established their personality [18]. The circumstance that most people have sufficient social and biological development to completely inhabit their identity, shows a consistency in observations and conducts affected by various factors. Simultaneously, youngsters can utilize their identities but this depends greatly on their situation, because they are easily drawn towards attractive things. Therefore environmental variables are essential for this paper's research, in terms of accomplishing its research objectives. The variables in this research have simply centred on environmentally-friendly attributes, environmental knowledge, recycling, perceived consumer effectiveness, resource saving, and scepticism towards environmental claims.

The energy and power cost savings are determined for the energy use in the interior lighting, Heating, Ventilation and Air Conditioning (HVAC), and Service Hot Water (SHW) systems. This is because the energy and peak demand for the interior lighting, HVAC, and SHW systems is calculated from the hourly annual energy simulations to determine the energy and power cost savings. A partially qualifying property saves at least 16.67% of energy and power costs through efficiency improvements in any one of the envelope, lighting, HVAC and SHW [19]. The Pacific Energy Efficiency Project by the International Institute for Energy Conservation was dramatically increasing the use of energy efficiency in developing countries.

Through bringing the progress in energy efficiency policy and implementation that has reduced energy consumption. The project focused on reducing energy consumption in the residential, commercial and public. The projects have resulted in 2015 for energy annual savings of 3,411 MWh, annual cost savings of US Dollar 1,458,922, and CO_2 savings of 3,204 tonnes/year. Xstrata Zinc has undertaken an innovative energy management project at its Brunswick Mine to recover waste energy from its zinc dryers' exhaust and to reusing the wasted energy. This project is already reducing energy consumption, greenhouse gas emissions and the emission of particles into the atmosphere, and reflects Xstrata's commitment to improving energy intensity and progressively reduce emissions. In 2007, the Brunswick mine achieved a 6% reduction in total energy consumption per annum (Mine *et al.*, 2007). Environmental Protection Agency (EPA) has worked with ENERGY STAR to help them save money and reduce greenhouse gas emissions by making their buildings and plants more energy efficient since 1992. Through ENERGY STAR, EPA provides tools and resources to improve the energy efficiency of building and plants. There is around 30% of the average energy wastes of a commercial building, therefore people must aware this problem to save energy at the building, especially for facilities managers. This organisation had provided a five-stage approach in the ENERGY STAR Building Upgrade Manual to maximise the energy savings and can help the building identify, implement, and measure energy savings. ENERGY STAR had certified certain office equipment for office buildings to reduce their energy consumption without influence their performance of regular tasks.

In this research, we just focus on the behaviour and actions of personality influences. Behaviour is the key to personality because it is what provides the ability for observation, interaction, and measurability. The behavioural theories state that personality develops as a result of an interaction between the individual and environment. According to this view, individuals develop consistent behaviour patterns because they have learned particular ways of responding. Behaviours that have positive consequences tend to increase and negative consequences tend to decrease. Learning behaviours can also through modelling or observation because everyone is exposed to different learning experiences and develop their own unique personality.

Behaviours also have the ability to change personality if they are able to affect an individual's perceptions. Someone who is highly neurotic may display a lot of anxiety-based behaviours such as rumination. This action of rumination creates the personality of someone who is considered a worry wart, but if the rumination diminishes in frequency this can alter the individual's perception. This can completely change the essence of who an individual is, giving them a more relaxed disposition. A relaxed disposition turns into calmer behaviours such as the ability to take risks and make decisive decisions. Personality structure can vary greatly between an individual with the different traits and characteristics they display, but all persons share a similar course when it comes to personality development.

Behavioural patterns are groups of related behaviours which describe how people behave [20]. With energy consumption behaviour, these patterns were difficult to describe compared to other energy behaviours such as conservation and energy saving. In energy behaviour studies, there are many researchers who have determined behavioural patterns particularly from a household perspective. These studies also have different point of views and different approaches in accessing and categorizing these patterns.

2.2 Personal Characteristics

Personnel's behaviour is more important to discuss in this research. This is because energy cannot run itself but it should run or apply by people. Reference [21] believe that the combination of two major disciplines of psychology and economics can influence people behaviour. Therefore, this research had selected the five-factor model of personality to discuss the behaviour. Five-factor model of personality included the traits of openness, conscientiousness, extraversion, agreeableness, and neuroticism, is a well-established theoretical model for describing how personality is structured. Traits are consistent over time and situations. Traits are also predictors of individual and social outcomes [22]. Basic personality traits may provide a partial explanation, but it is unclear which personality traits are reliably associated with pro-environmental behaviours. Reference [23] used a specific type of environmental behaviour to clarify which personality correlates are most robustly associated with behaviour and to test mediation of those effects through attitudes. Accounting for demographics, emissions-reducing behaviours were most strongly predicted by Openness, Conscientiousness, and Extraversion, and these effects of personality were mediated by attitudes toward the natural environment. Individuals differ on stable psychological features. These differences have been conceptualised at many levels, from broad temperaments of approach and avoidance motivation to various taxonomies of personality traits [24]. A vast literature on personality structure and assessment supports a descriptive theory of five broad and replicable personality traits, often labelled as Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Openness reflects rich, abstract thinking and an appreciation for the variety and unusual experiences. Conscientiousness is indicated by high levels of self-discipline, respect for duty, and desire for achievement. Extraversion is characterised by an energetic engagement with the world, sociability, and breadth of activities. Agreeableness is the tendency to value social harmony and getting along with others. Finally, Neuroticism is the tendency to experience negative emotions, such as anger, anxiety, and depression. Core personality traits, such as are promising candidates for individual differences predictors of environmental behaviour because they are cross-culturally reliable have excellent internal validity, and may partially determine factors such as attitudes.

Personality has been used in the psychological sciences to identify many types of traits that people exhibit that influence behaviour. A better understanding of personality traits that correlate with pro-environmental attitudes and behaviours can help psychologists understand how to design messages and behavioural models to facilitate people making better decisions to preserve the environment. Reference [25] states that there is a positive correlation between environmental concern and the personality traits of agreeableness and openness while the traits of neuroticism and conscientiousness also have correlation but not as strongly. In short, the theories background of research and select the potential and relevant that can influence the energy saving behaviour to determine either the people is saver or non-saver. Based on the discussion, the demography, personality characteristics and environmental variables will be combining to reach the research objectives. For this research, only select the relevant variables to assess energy saving behaviour among the people who work in office buildings as the basic knowledge for facilities managers in managing the building. Research on energy saving behaviour needs to be done seriously in Malaysian office buildings to avoid the adverse consequences. A lot of factors can influence the employees' behaviour and lead to their energy saving patterns. The results of determining the factors can provide important information to facilities manager for better energy management in the office building.

3. METHODOLOGY

This research included two main methodology stages, namely collecting data from 400 employees who work in the selected Johor Bahru office building, specifically in regards to their energy saving practices, and then analysing that data.

3.1 Stage One: Research Background

The first stage of this study was to determine the concepts, problem statement, literature review, objectives and the research question. The main word in this research is energy saving and people behaviour. Since the energy consumption in the world had increased rapidly and most consume by the commercial sector. Thus, the Malaysian office buildings (Johor Bahru) have selected to reduce the energy use because that is easy conduct the energy conservation than other filed in the commercial sector. This is the issue discuss by media and often had the research to discuss. Based on the issue, the problem statement is about the energy consumption increase lead to CO_2 emission increase. This happened to impact our environment pollution increase speedily indirectly. At ordinary time, people will pay electrical bills as their consumed, therefore they will control their energy consumption to avoid the cost they pay decrease. However, the employees who work in the office building will not consider their energy consumption and just care about their comfort to increase their working performance because the electrical bills are not paid by them. This issue had take

note by the building administrative level to reduce their cost and get the highest return. Thus, facilities managers need have the knowledge about energy saving pattern by personnel behaviour to take some action and solve the problem. In accordance with the literature review, this research wills more emphasis on the environmental variables factor that [26] found out to help the facilities managers understanding the personnel behaviour in energy-related-behaviours. The result comes out from this research is important for facilities managers from getting the colleagues' energy saving behaviour and pattern to help them reduce the energy consume.

3.2 Stage Two: Achievement of Research Objective

The first objective of this research is to determine energy saving pattern from personnel behaviour in Malaysian office building and to analyse variables that influence the energy saving pattern of employees. Based on [7], energy saving pattern can divide into two types, which are saver and non-carer. The variables that influence the patterns will accord the demography, personal characteristics and environmental variables that found out by [26].

3.2.2 Questionnaire design

The questionnaire consists of three main sections. Section A is designed to get the profile of responders. That was including the demography of responders which are gender, age, education and monthly income. According to the literature review, the background of responders was important to determine the energy saving patterns and behaviour. Section B is based on the personal characteristics because it will change the people behaviours can action towards energy use. Section C is according to the environmental variables that found out by [26] to list out the 10-linker scale questions for responders to the response by ticking their perspective for that question. The result from the responder is important for determine their energy saving pattern (Objective 1). That had determined two type of energy saving pattern from [7], the benchmark index which below 50 is considered as Non-carers; above 50 is considered. The number that marked by responders would total up and get the average mark to reach the first objective. Furthermore, the marked for each question by responders had taken to analyse the correlation and significant of variables to determine the energy saving behaviour (Objective 2).

The study involved 331 respondents, who worked in the Johor Bahru office building. The questionnaire was fully answered by the respondents, and it comprised demography factors, personal characteristics, and environmental variables. The respondent can treat the designed questionnaire as a self-report, in regards to energy-related-behaviour. Next a cross tabulation analysis has been conducted for section A, while data in Section B was compared with the outcomes of previous studies. Binary logistic regression was conducted in Section C, in order to explain if environmental variables can affect behaviour.

Table 1. Research method and tools.

Objectives	Tools	Expected Outcome
One	Descriptive analysis	Determining energy saving patterns
Two	Cross-tabulation and binary Logistics Regression	Determining variables that can influence energy saving patterns and behaviours

4.   FINDINGS

The study's respondents were comprised of 121 men and 210 women from the Johor Bahru office building. Out of all the respondents, 75 people were aged between 16 and 25 years, 130 between 26 and 35 years, 111 between 36 and 45 years, 12 between 46 and 55 years, and the remaining three individuals were between 56 and 65 years old. Moreover, the respondents were from a range of national backgrounds, with 208 people being Chinese,

105 Malay, 15 Indian, and 3 people from other nationalities. The vast majority of them (150 individuals) had SPM (Sijil Pelajaran Malaysia) as their highest education level, and were regularly earning a wage between US$604 and US$967 (158 people). The majority of respondents (252 persons) were staff. Among the respondents, 305 identified themselves as energy savers.

Table 2. Energy saving profile pattern.

Profile		Energy saving patterns	
		Saver	Non-Saver
Gender	Male	104	17
	Female	201	9
Ages (in years)	16 - 25	70	5
	26 - 35	120	10
	36 - 45	100	11
	46 - 55	12	0
	56 - 65	3	0
Education	SPM	135	15
	Diploma	43	3
	Bachelors' Degree	107	7
	Masters' Degree	7	0
	PHD	3	0
	Others	10	1
Income (US$)	242 and below	14	2
	243 – 603	80	6
	604 – 967	149	9
	968 – 1329	41	6
	1330 and above	21	3

For their first characteristic, 165 people (49.8% of respondents) chose agreeableness. About 28.4% of the respondents placed extraversion as their second characteristic. Additionally, 34.1% of respondents chose the openness characteristic as their third characteristic. Most respondents, specifically 52.6%, presented neuroticism as their last characteristics. Conscientiousness was picked as the fourth characteristic by 35.0% of respondents. Generally speaking, extraversion relates to being excitable, sociable, talkative, friendly, and engaging. Openness relates to being imaginative, insightful, adventurous and creative. Neuroticism relates to sadness, moodiness, and emotional instability. Conscientiousness relates to high levels of thoughtfulness, with good impulse control. Last but not least, agreeableness relates to trust, altruism, kindness, affection, and being easily influenced by others.

Each respondent completed Section C, related to environmental variables. The analysis concentrated on seven principle variables which can impact energy saving. The outcome of the descriptive statistical analysis demonstrated that a greater amount of respondents have environmental knowledge, but still had no concern about the environment. Generally, EnvC (Environmental concern) defines people who are careful when shopping, and having an eco-friendly buying behaviour, while it also refers to people who are also interested in searching for information and collaborating in energy saving activities. EnvK (Environmental knowledge) defines people with knowledge about potential impacts on the environment, including the greenhouse effect, acid rain, ozone depletion, and the need to limit pollution in order to protect the environment. Rec (Recycling) defines people with a willingness to recycle, separate packages, and encourage others to behave in a similar way. PerCE (perceived consumer effectiveness) defines people who are concerned with environment problems, and who believe that individual actions can help solve problems. ResS (resource saving) defines people who will save resources, in order to reduce the quantity of rubbish being produced. ScepEnvC (scepticism towards environmental claims) defines consumer reactions to promotional

messages, such as advertising, packages and labelling. Inc (income) refers to economic power, and the willingness to pay for energy-efficient appliances.

The first objective of this research is to determine energy saving patterns from personnel behaviour within a Malaysian office building. Based on the above analysis, further analysis will be implemented through only two energy saving behaviour patterns. In reference to an analysis result from a study implemented by [8], 305 of the respondents can be identified as being Savers, with calculated average points of greater than 5. Conversely, 26 respondents are recognised as being energy Non-Savers, with less than 5 average points. The formula for the calculation is presented as shown below:

$$\text{Saver} = \frac{\sum (\text{EnvC} + \text{EnvK} + \text{Rec} + \text{PerCE} + \text{ResS} + \text{Scep} + \text{Inc})}{25 \text{ questions}} \quad (1)$$
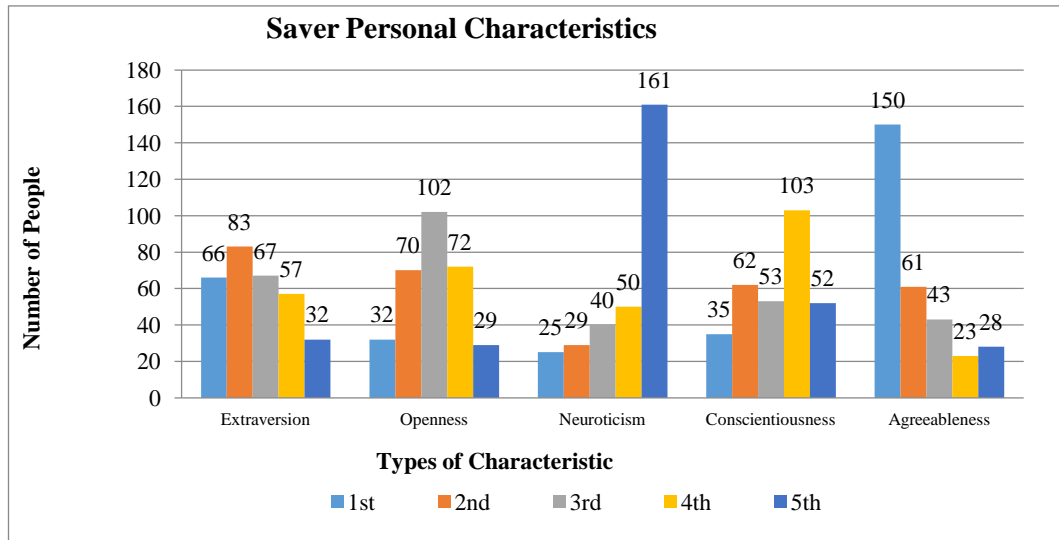

Fig. 2. Frequency analysis of energy saver characteristics.

Figure 2 presents the self-reports of respondent's ranges regarding personal characteristics, 27.2% of respondents chose extraversion as their second characteristic, 33.4% of respondents chose openness as their third characteristic. The majority of respondents (52.8%) chose neuroticism as their last characteristic. 33.8% of respondents chose conscientiousness as their fourth characteristic. Additionally, 165 respondents (49.2%), considered agreeableness to be their fifth characteristic. In other words, a saver has agreeableness as their first characteristic, extraversion as their second characteristic, openness as their third characteristic, conscientiousness as their fourth characteristic, and neuroticism as their fifth characteristic. According to previous research by other authors, agreeableness is the first characteristic, openness is the second characteristic, conscientiousness is the third characteristic, neuroticism is the fourth characteristic, and extraversion is the fifth characteristic.

Figure 3 presents respondent's self-reports, as related to their range of personal characteristics. Normally, extraversion is placed as a second characteristic by 42.3% of respondents. About 42.35% of respondents also feel that the openness characteristics comes at the third. Neuroticism was picked by 50% of respondents (a majority), as their last characteristic. Conscientiousness was chosen 50% of participants as being their fourth characteristic. Moreover, 165 people (57.7%) selected agreeableness as their first characteristic. To put this is a simpler way, it can be

considered that the non-saver has agreeableness as their first characteristic, extraversion or openness as their second or third characteristic, and conscientiousness or neuroticism as their fourth or fifth characteristic. However, results from previous research have shown that the non-saver's first characteristic is extraversion, because they lack a relationship with their environment. Their second characteristic is neuroticism, their third characteristic is conscientiousness, and their fourth and fifth characteristics are openness and agreeableness, respectively.

From Table 3, it can be determined that the position of characteristics in both saver and non-saver patterns are identical. The characteristics, as ranked from first to fifth, are agreeableness, extraversion, openness, conscientiousness and neuroticism. This indicates that, generally, all respondents have matching characteristic positions. However, this may be influenced by other factors that cause difference in action between persons.

The outcomes presented in Table 4 demonstrate the means of points that respondents obtained for each of the two patterns, namely the saver and non-saver patterns. The saver pattern is influenced by environmental knowledge towards energy-saving, given that it has the highest variables, while for non-savers, perceived consumer effectiveness is the most important variable that affects their energy-saving behaviour. For their least important variables which impact behaviours regarding energy saving, the saver pattern selects environmental concern, while the non-saver pattern

selects income. This indicates that savers and non-savers have different opinions regarding variables that have less impact on energy saving. The research second objective works to analyse variables that influence employee energy saving behaviours. The factors influencing energy saving behaviour patterns were averaged, before the analysing process was undertaken in order to facilitate analysis and interpretation. In order to test the correlation between demography variables and patterns, cross-tabulation was conducted. Be that as it may, there are a few alterations required for each sub-variable in Section C testing, which are the most critical for the main environmental variables. Hence, a factor analysis is implemented through this procedure. Its aim is to decrease the data set's complexity. Lastly, binary logistic analysis has been chosen as a means of breaking down environmental variables, against behaviour and patterns.

Table 3. Comparison of frequency analysis.

Positions of characteristic	Patterns	
	Saver	Non-saver
1st	Agreeableness	Agreeableness
2nd	Extraversion	Extraversion
3rd	Openness	Openness
4th	Conscientiousness	Conscientiousness
5th	Neuroticism	Neuroticism

Table 4. Comparisons determined from descriptive analysis.

Variables		Mean Saver	Mean Non-saver	Mean Overall
EnvC	Q1	6.15	5.95	3.58
	Q2	6.80	6.59	4.04
	Q3	6.52	6.30	3.69
	Q4	5.76	5.57	3.23
EnvK	Q5	8.23	7.89	4.23
	Q6	8.59	8.25	4.23
	Q7	8.75	8.44	4.81
Rec	Q8	6.86	6.60	3.50
	Q9	6.54	6.33	3.81
	Q10	7.55	7.27	3.96
	Q11	8.14	7.82	4.35
PerCE	Q12	6.65	6.40	3.46
	Q13	6.13	5.92	3.46
	Q14	8.17	7.84	3.96
	Q15	6.42	6.36	5.65
	Q16	7.83	7.55	4.27
ResS	Q17	6.80	6.66	5.12
	Q18	7.81	7.51	4.04
	Q19	6.81	6.62	4.31
	Q20	7.25	7.05	4.73
ScepEnvC	Q21	6.95	6.71	3.96
	Q22	7.13	6.87	3.85
	Q23	6.66	6.48	4.42
Inc	Q24	6.65	6.37	3.12
	Q25	6.76	6.53	3.88

Seventeen males and nine females were identified as being non-savers, leaving 104 males and 201 females as savers. Therefore, 7.9% of respondents can be classified as non-savers, while the remaining 92.1% can be classified as savers. From the results, it can be seen that there are fewer female non-savers (2.7%) than male non-savers (5.1%). Correspondingly, only 31.4% of males are savers, while 60.7% of females are savers. It is consequently evident that there are more female savers than male savers.

According to research conducted by [8], it has been concluded that in terms of saving energy resources, women display more favourable behaviour than men do. A study done by [27] also agreed that females show a higher level of environmental concern, with respect to their conservation behaviour. It also shows that a greater rate of women perform environmentally-friendlier behaviour.

There are five groups of age ranges within this research, including respondents aged 16 to 25, those aged 26 to 35, those aged 36 to 45, those aged 46 to 55, and those aged 56 to 65. Based on the result for the 16 to 25 years age group, 5 respondents were non-savers, and 70 of them were savers. For the next age group, aged 26 to 35, 10 were non-savers and 120 were savers. There are 11 non-savers and 100 savers in the group aged 36 to 45, while in the 46 to 55 age group, none were non-savers, and 12 were savers. Likewise, in the 56 to 65 age

group there were no non-savers and three savers. This proves that 7.9% of the respondents are non-savers, and the remaining 92.1% are savers. By using percentage as a comparison method, the results show that individuals aged 36 to 45 years have the highest rate of savers, at 9.85%. It can be theorized that households of older individuals have fewer household appliances, when compared to those of younger individuals. Nevertheless, it is worth noting that younger people are more inclined to choose the latest technology which seems more efficient. In contrast, older people use old appliances, which they only occasionally replace [28].

In terms of educational level, 15 non-savers and 135 savers identified SPM as their highest education level. Also, STPM was selected as the highest education level for 3 non-savers and 43 savers. Moreover, 7 non-savers and 107 savers indicated that a bachelors' degree was their highest education level. Additionally, no non-savers have masters' degrees or PHDs. Among savers, 7 respondents and 3 respondents indicated masters' degrees and PHDs as their highest educational level, respectively. Therefore, it can be concluded that 92.1%

of savers have a strong educational level, compared to only 7.9% for non-savers. Based on the total percentage outcome, the highest educational level obtained by the non-saver respondents is SPM (at 9.93%).

Among non-savers, 7.7% of respondents marked their personal monthly incomes as being at US$242 or less. For those with income ranges between US$243 and US$603, and between US$968 and US$1329, 23.1% of both are non-savers. Also, 34.6% of non-saver respondents stated that their monthly income stood between US$604 and US$967, while the remaining 11.5% received US$1330 or more. Meanwhile for savers, 4.6% earned US$242 or less each month, while 26.2% of respondents indicated that their income ranged between US$243 and US$603. About 48.9% of savers indicated that their income ranged between US$604 and US$967 and 13.4% of respondents earned between US$968 and US$1329, while the remaining 6.9% earned US$1330 or more each month. In a nutshell, the personal monthly income of most respondents lies between US$604 and US$967.

Table 5. Result comparison with previous studies (focusing on savers).

Characteristic	Result from this study's respondents	Result from previous study's respondents
1st	Agreeableness	Agreeableness
2nd	Extraversion	Openness
3rd	Openness	Conscientiousness
4th	Conscientiousness	Neuroticism
5th	Neuroticism	Extraversion

Table 6. Result comparison with previous studies (focusing on non-savers).

Characteristic	Result from this study's respondents	Result from previous study's research
1st	Agreeableness	Extraversion
2nd	Extraversion	Neuroticism
3rd	Openness	Conscientiousness
4th	Conscientiousness	Openness
5th	Neuroticism	Agreeableness

Table 7. Regression result.

Variables	B	Significant
EnvC	4.111	.153
EnvK	6.429	.043
PerCE	3.104	.399
ResS	8.244	.056
Inc	6.722	.070
Constant	-144.430	.032

Tables 5 and 6 illustrate a comparison of respondent's characteristic's ranges, comparing the study presented here, and previous research. When comparing both sets of results, it can be determined that there is only a slight difference between the results for savers.

In this research, the extraversion characteristic is placed second, while in past research respondents have chosen extraversion as being their last characteristic.

Despite this, discoveries from previous research can still be utilized, because they establish the

relationship between extraversion characteristics and environmental consideration. Reference [29] stated that the extraverted individuals often actively seek pleasurable and new experiences Messages about environmental tourism to exotic places may be more appealing to an extraverted person. An extraverted person may be more interested and attracted by messages about environmental tourism in exotic places. These messages related to the environment could raise individual awareness about how to enjoy a vacation in a more pro-environmental manner.

On the contrary, a comparison of respondent characteristics between this research and research previous conducted, showed vast difference. Be that as it may, it cannot be concluded that past research is wrong, due to past research only focusing on savers, and not on non-savers. As a result, it is worth noting that personal characteristics have a significant impact on energy-saving behaviours and patterns.

According to results shown in Table 6, the EnvC and PerCE variables are shown to not have a significant impact on energy saving behaviour patterns, with positive directions of (β = 4.111) and (β = 0.399), respectively. On the other hand, the EnvK, ResS and Inc variables have been calculated to be significant in patterns with (β = 6.429), (β = 8.244) and (β = 6.722) as respective positive directions. By inserting 0 into all of predictor variables, the value of the log-odds of patterns is expected to be -144.430. Therefore, after all variables are inserted into correct places, the regression equation can be presented as below:

$$\ln(\text{odds}) = -144.430 + 4.111(\textbf{EnvC}) + 6.429(\textbf{EnvK}) + 3.104(\textbf{PerCE}) + 8.244(\textbf{ResS}) + 6.722\,(\textbf{Inc}) \qquad (2)$$

Table 8. Energy saving pattern summaries.

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	0	26	7.9	7.9	7.9
	1	305	92.1	92.1	100.0
Total		331	100.0	100.0	

Table 9. Classification table step 0.

Observed		Predicted		Percentage Correct
		Pattern		
		0	1	
Pattern	0	0	26	0.0
	1	0	305	100.0
Overall Percentage				92.1

a. Constant is included in the model.
b. The cut value is .500

Table 10. Classification table step 1.

Observed		Predicted		Percentage Correct
		Pattern		
		0	1	
Pattern	0	26	0	100.0
	1	1	304	99.7
Overall Percentage				99.7

a. The cut value is .500

It can be shown from the overall percentage that dependent variables have been correctly predicted through the given model. It can be noted that the output of this model is 92.1%, or specifically 305 out of 331. Moreover, there are 26 respondents that have been classified as non-savers, through observation. These 26 non-saver respondents were all not predicted to be non-savers, when running an intercept-only model. Therefore, there is a 0% accuracy rate for non-savers. In addition, through observation, 305 respondents were identified as savers. All 305 respondents were predicted as being savers, based on the intercept-only model. This prediction can all be seen through all calculations. Therefore, with a 100% classification accuracy and an overall accuracy of 92.1%, with reference to Table 9, the results can be considered to be almost similar. Based on Table 9, the savers (92.1%) fell into group code 1, while the non-savers (7.9%) fell into group code 0.

The outcomes from the logistic regression calculation can be utilized in further classifying subjects, with respect to the decided type of energy-saving pattern. As stated before, the calculated model made a lead prediction that forecasted 92.1% of respondents as being energy savers, and 7.9% as being non-savers. The overall fit of classification accuracy, in terms of the predicted group and the actual group, can be seen in the classification table. This table summarizes the classification accuracy in a hit or miss format, and at the same time indicates that respondents are classified in each respective group correctly, as based on the model. Based on the saver and non-saver variables, the value can be observed from the result shown above. Table 10 indicates non-savers, and one saver, as a dependent variable. Based on the full logistic regression model, the predicted values of the dependent variable indicated that 26 cases are observed to be 0, and are correctly predicted to be 0. Meanwhile, 304 cases are observed to be 1, and are correctly predicted to be 1. However, there is 1 case that is observed as 1, but was predicted to be 0. The table also discloses the overall percent of cases that

are correctly predicted by the model. Based on the table, the percentage from the null model increased in the full model, from 92.1% to 99.7%, respectively.

For non-savers there is a 100% classification accuracy, and there is no misclassification from the information presented. On the other hand, the saver's classification accuracy shows an amazing result with a percentage of 99.7%. In terms of correct classification, this achievement can be considered a good one. Consequently, the remaining 1 misses are basically a false negative, when 1 individual is predicted to be a non-saver, while the person is actually a saver. Hence, this individual represents the remaining 0.3 % of cases, from the results shown. Since the research discovered 26 non-savers and 204 savers, the overall size can be determined by adding both numbers, resulting in 330. The 99.7% classification accuracy rate was calculated by dividing the correctly-classified cases with the overall classification, which is 330 and 331, respectively. It also worth noting that the misclassified percentage is the remaining 0.3%. In conclusion, these calculations show that the model is fit to be used globally, and that the model represented by the research displays a significant improvement and fit over a null model.

5. CONCLUSION

The findings were identified that had 92.1% of the respondents as a saver which had the average point is more than 5. Female respondents mainly described as a saver with 65.9%. The age group of this pattern more in between 26-35 years old (44.3%). Most of them had their highest education level by SPM and get the personal income in a group of US$604 – US$967 (48.9%). Furthermore, the findings were identified that there was 7.9% of the respondents as a non-saver which had the average point that less than 5. Male respondents mainly described as a non-saver with 65.4%. The age group of this pattern were more in between 36-45 years old (42.3%). Most of them also had their highest education level by SPM and get the personal income in a group of US$604 – US$967 (48.9%). Results shown there are two types of energy saving pattern, namely, Saver and Non-saver. From the results, the research found out that gender, age, education and income based on the frequency analysis is the factors that influence the energy saving patterns. Among the environmental variable, the environmental concern, environmental knowledge, perceived consumer effectiveness, resource saving and income also indicated as the significant factors that influence the energy saving behaviour. Through the analysis, information of energy saving patterns and the factors influencing them are important to facilities manager. This information is fundamental for recognizing energy management problems in Malaysian office building.

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