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ENERGY SAVING IN RESIDENTIAL BUILDINGS: RESIDENT'S EFFORT AND AWARENESS

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ABSTRACT

Energy is one of the most important sources to modern human lifestyle. As a result of too much energy consumption, excessive carbon emission has occurred and resulting in global warming. Due to this cause, a lot of sustainable programs have been organized by different parties to preserve the environment in the future. Therefore, this study was undertaken to assess the level of awareness and efforts among the occupants of residential buildings in adapting energy conserving practices in their daily life. This study involved 100 respondents, randomly chosen and by using the distribution of questionnaires. The analysis that is used to achieve the objectives of the study was Cross Tabulation Analysis, Frequency Analysis, and Likert Scale Analysis. The study found that occupants of residential buildings contribute a high effort in adopting energy conserve practice in daily life. In order to practice energy saving, the use of energy-efficient equipment and changing behavioral in energy consumption are the two methods used to save energy. It is found that, the respondents used both in practice.

1.0 INTRODUCTION

Nowadays, energy is the human being's most important origin. The country's growth become more difficult as the demand for buildings and house continues to rise. Moreover, industry, transportation system and other businesses are in the same situation.

According to World Energy (2019), global energy usage was not in good shape because annual energy consumption is growing. Industry consumes about 195 million cubic meters of natural gas, which is 5.3%. This natural gas figure shows the fastest growth since 1984. This was accompanied by oil with a consumption rate of 4.3%. The consequence of rising energy demand are greenhouse gas emissions and a few environmental issues such as climate changing and global warming.

Just 11% of the world's energy savings are used properly and the remainders are waste. (Cullen and Allwood, 2010). A research carried by UNDP (2011), in 2008 and 2009 Malaysia buildings have a high energy consumption of over 7,750 gWh and greenhouse emissions of about 7.5% equivalent to 5,301 kilograms of greenhouse gases.

Meanwhile, Shahrul Nizam (2013) states that approximately 40% of global energy was used for buildings and 1/3 greenhouse gases were used to generate electricity from burning fossil fuels. According to Hassan *et al*. (2014), the use of modern home appliances is one of the main factors causing the highest use of power, as well as lighting as a second major factor. Next, Rozana *et al*. (2012) states about 40% of greenhouse gas

emissions are related to human behavior and also increasing the impact of greenhouse gas emissions in Malaysia. Public actions played a major role in saving energy.

This study aims to identify the level of awareness among residents in residential buildings about energy conservation in order to achieve sustainability for future generations' use.

2.0 IMPLEMENTATION OF ENERGY SAVING IN RESIDENTIAL BUILDING

Every humankind needs shelter to rest. In other words, it may refer to shelter as a home. According to OECD (2015), building can be defined as a house where the dwelling is used as a shelter. Residential building can be classified into residential buildings which are lands and strata residential. Nevertheless, the example of strata property such as condos and apartment while landed property are terrace and bungalow. As for GBE-bund (2015), interpret that the residential building depends on the size of the space. To conclude, every building is known as a residential building although only half of the space is used.

2.1 The use of energy saving in residential buildings

Normally, as the country is undergoing modernization, residential buildings are also equipped with modern technology such as television, air conditioning, water heater and other modern furniture. This modern equipment is used to meet the comfort and needs of the home. 40% of the energy consumption is from the energy consumption, which is from electricity. Compared to commercial buildings, residential buildings use 25% more electrical energy. (Krarti, 2012) Rising in the residential construction sector is due to household income growth. There is an increasing number of residential buildings, hence the use of energy is also increasing. Energy use is more intended for entertainment gadgets, computing and lighting. (U.S Department of Energy, 2008). In the construction phase, the operation phase made a major contribution to the use of energy (You *et al.*, 2011). This is due to the increase in the occupancy and activity rate in the building.

A research by Kubota *et al.* (2015), states that use of air conditioning is within six hours and it is used by 65% of the residential community. The urban society wants its own cozy. This is because Malaysia is having rainy and hot season. This led to the use of air conditioning among urban societies. In Denmark, research in residential buildings show that 70% of electrical energy is used for heating and cooling purposes. The total energy consumption in Denmark is around 30%.

According to Tenaga Nasional Berhad (2015), the use of electricity depends on the size of the household that influences the cost of use, the quantity of electrical equipment and the time use of power. Next, based on Association of Water & Energy Research Malaysia (AWER) (2015), states that there are three factors contributing to the use of electricity. First, is the frequency of electrical use, the amount of electrical equipment used and the time of energy use.

2.2 Energy saving

Energy saving is an important aspect of residential buildings. It is because too much electrical equipment is being used by the community. The purpose of energy saving is to reduce non-renewable sources. In addition, it helps reduce negative effects on the environment, reduces the emissions of toxic gases, which can harm humans and reduce cost (Sabah Electricity Sdn Bhd, 2013). Through energy saving, it can help avoid any waste, reduce costs and reduce the cost of living. According to AWER (2011), energy saving is one step towards reducing energy use without disrupting their comfort life and being able to perform their daily routine. While, Steg (2008) says that the reduction of energy use among households is due to the use of environmentally friendly energy equipment and human attitudes towards energy saving practices. This is because based on AWER (2011) shows that the use of eco-friendly power equipment is 25% more efficient than conventional equipment. Besides, it also can reduce 25% of carbon dioxide rate.

Knowledge of the value of conserving energy is important in helping change the habit or practice and attitude towards consuming energy. This is to ensure that the public is aware of environmental issues and energy saving. Gyberg (2009) emphasize that changing the attitudes and behaviors can have a positive effect on the environment. For example, the habit of switching off the lamp and electronic equipment while not using it should be set as an example to save energy by changing lifestyle. Here is another different view from Bertoldi *et al*. (2001), which state that there are two approaches can be used to achieve sustainable life. The first strategies are to provide innovative product, high quality product, accessible to the customer and to coordinate effective programs. The last strategies are the implementation of policy and related legislation.

Through the prediction by Energy Outlook Report (2014), if energy savings and building code are used together and efficient energy technology is used in residential areas, 20% of energy can be saved. These demonstrate that the use of energy-efficient equipment does not really have a good effect if it is not used with the policy endorsed. Enforcement of the use of building code helps to increase energy efficiency for building development. Research shows that approximately 47% of home buyers put energy saving as their main priority when buying property. (U.S Department of Energy, 2008)

2.3 Energy saving in foreign country

Germany was listed in 2014 as the country with the most efficient approach for energy saving, this is based on The International Energy Efficient Score Card (EES) (Al-Jazera, 2014). This is due to the effectiveness of the programs, the enforcement of policies and the cooperation of all parties. At the beginning of the 1970s, all parties engaged in energy savings in Germany. The energy wind programs organized in Germany can help to convert energy into renewable energy and also help to increase the rate of energy saving. This program has a positive impact on the economy sector, where the emissions of carbon gases have decreased from 3% to 2.8% and electricity from about 1.4% (Lovins, 2007). Germany is taking a few steps to stop the entire nuclear power generator in 2050, after the Fukushima tragedy in 2011.

According to Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2015), energy saving in Germany can be achieved in three ways. The three ways are to reduce the demand, encourage an alternative way, distribute information and provide advice. Limiting the demand can be done by an enforcement act, such as the Heating Cost Act (HeizkostenV) (1981), Renewable Energy and Heat Act (EEarmeg) (2009). The enforcement of the policy and building code applies not only to commercial buildings, but also to residential buildings.

2.4 Energy saving in Malaysia

In Malaysia, the Act and policy had been used since 1960s, the purpose of these are to control energy consumption. Under Petroleum Development Act 1974, this act allows the national oil company, PETRONAS to explore the oil sources in this country. This followed by National Petroleum Policy 1975, Energy Policy National 1979, National Reduction Policy 1980, Four Energy Strategies 1981 and 2001. Recently, these acts had been amended to Commission Energy Act 2001 and Supply Energy Act 1990.

In 2010, the United Nations launched the Building Sector Energy Efficiency Project (BSEEP) to help implement energy savings for the construction sector in Malaysia. In addition, the implementation of this program aims to increase the rate of energy use in buildings and to promote a new energy saving design for new buildings in Malaysia. (Hor, 2014) Beside that, Malaysia also implement a number of policies related to the Management of Electrical Savings Rule (2008) in Government Buildings, Energy Audit and Retrofit in Government Buildings (2014) and GreenRe (2014). (Hor, 2014).

Standard Minimum Energy Performance (MEPS) will be provided to each country as a guideline for the efficient use of energy in buildings. Standard MS 1525: 2007 used by Malaysia as a guideline for commercial building. In the meantime, for residential buildings, Malaysia will refer to the Energy Commissioner's Guide to Efficient Energy Use at

Home. However, this guideline is only used as a reference and not mandatory for community use.

2.5 Energy saving in Denmark

The Danish Energy Policy has been in place in Denmark since 1970s. However, Denmark has also added a baseline to help to reduce energy consumption in the country. The baseline of the Danish Energy Agency carried out by Denmark in order to identify and analyze the number of economic, technological and commercial energy consumption. This baseline focused on the cost and output of energy consumption of all economic activities in Denmark. (Centre for Energy Efficiency, 2017)

Danish 2020 Standard or known as Building Class 2020, under this standard, Denmark has designed a building model that is a highly energy efficient building in Denmark. This building will only consume 41.45 kWh/m² and believed to be the top energy efficient building. In addition, this building equipped with energy efficient technology such as LED lighting and underfloor heating. (Muhyiddine Jradi *et al*, 2017)

3.0 GREEN TECHNOLOGY PRINCIPLE

Based on a speech by Former Prime Minister of Malaysia, Dato' Seri Najib Tun Razak in the Copenhagen Accord (COP 15) said that carbon emissions will be reduced by up to 40% compared to 2005 emissions. Malaysia's 10th Plan stated that the objective is to achieve sustainable development through the implementation of a few supported programs and the availability of green technology in terms of equipment and application. As a result of the change of cabinet in 2009, the Ministry of Energy, Communication and Multimedia changed to the Ministry of Energy, Green Technology and Water of KeTTHA. The revised National Green Technology Principle (NTGP) is one of KeTTHA's initiatives to achieve sustainable development and increase the economy of the country by reducing the rate of energy use. Due to the demand for green technology that had been widely used throughout the world, using this principle, green innovation from Malaysia can be brought to an international level.

3.1 Green Technology

Wide use of technology can have a positive impact on the community around the world. Innovation through technology can lead to the green technology that can achieve sustainable development and this is one of the steps to protect our environment.

Based on GreenTech Malaysia 92015), green technology can be defined as the use of products and systems of equipment to protect the environment. This can be achieved by minimizing human activity. (Oh *et al*., 92010), define green technology is one of the technologies used to minimize the environmental impact. This shows that the community is moving forward as time had changed.

The use of green technology by the National Green Policy can be approached through 4 initiatives, namely the Technology Financial Scheme (GTFS), Low Carbon City, Low Carbon Cities Framework and Assessment System, Green Transport/Low Carbon Technology Information and Green Tag Mechanism. Cooperation between KeTTHA and GreenTech Malaysia has organized a program called "green labeling" or "green tag" for eco-friendly products consisting of "Eco Label", "Carbon Footprint Label" and "Efficient Energy Assessment" (Gunting, 2012)

3.2 Efficient energy product

Any efficient energy equipment may be identified by the label shown on the equipment package. Energy Star labeling that is protected by the U.S Environmental Agency has been used in the United States. This is an easy way to identify the energy saving product. According to Krarti (2012), the purpose of labeling is to raise awareness and identify energy-saving products prior to purchase. Labeling can be divided into three categories: eco-labeling, energy-efficient stamping and saving-labeling. Each country has its own labeling system and needs guidance to support the system.

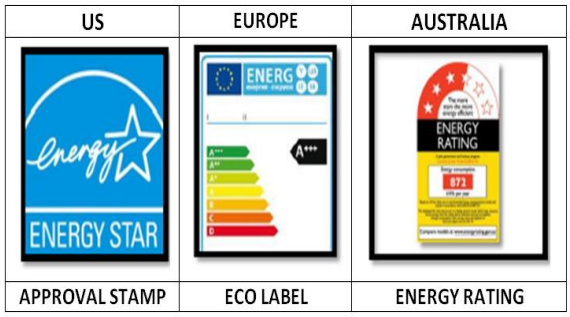

Figure 1: Examples of energy saving labeling.
Source: Energy Star (2015)

By saving energy, KeTTHA urges the Malaysian community to use energy efficient equipment. Equipment labeled "EE" which means energy efficiency at a rate from 1 to 5 that is more efficient in energy consumption. It known as 5 STAR or 5 STAR label and is protected by the Malaysian Energy Commissioner in cooperation with SIRIM.

Figure 2: Malaysia energy-efficient labeling
Source: Energy Commissioner (2015)

"SAVE" campaign launched by KeTTHA supported by the Economic Transformation Program (ETP) in 2011, involving the Malaysian community by giving RM100 rebate for every purchase of efficient energy equipment. The aim of this campaign is to encourage Malaysians to purchase recognized 5-star label equipment. This rebate only used to purchase equipment with not more than 200kWh and do not exceed 400kWh per month. This service is provided only to those with low and medium incomes. This facility also applies to those who registered under Tenaga Nasional, Sesco Company Bhd or Sabah Electricity Sdn Bhd.

The energy consumption of residential buildings is lower than that of conventional building. For example, the normal refrigerator consumes less than 40% if compared to the conventional refrigerator model. (Meng, 2011). The benefit of using 5-star technology equipment can reduce the cost of electrical energy in one residence and have a greater impact on quality of life. In addition, it is also possible to reduce the carbon footprint. (Tenaga Nasional Berhad, 2015)

3.3 Air Conditioner

The demand for air-conditioning is on the rise because of service and the construction sector is on the rise. In addition, the hot weather causes a high consumption of the air conditioner and gives the consumer a comfortable life. According to Sivak (2009), the high demand for air conditioning is due to the hot weather and the highest population in the city. The energy saving rate for air conditioners depends on the calculation of the energy saving rate or the Energy Efficient Ratio (EER). The higher the EER rate, the more efficient the consumption of the air conditioner. It depends on the capacity and the type of equipment used. (Matulka, 2015).

Energy savings in air conditioner consumption are due to the time of use of the air conditioner. In addition, the maintenance of this air conditioner must be checked regularly to ensure that it is always in a good and stable condition.

3.4 Lighting

There are a few forms of lighting that can save energy than any other kind of lighting. For example, LED or Light Emitting Diodes. Rosenthal (2009), states that LED can save up to 2 times more energy compared to light bulbs. LED lamps are more environmentally friendly and long-lasting, up to 20 years. According to Breandkampft (2010), the halogen lamp used 35 Watt of electrical energy, while led lamp only required 2 Watt of energy. The comparison between Halogens, CFL and LED lamp saves 90% of its energy. In addition, LED lamp is more durable if compared to Halogen and CFL.

TYPE	HALOGEN	CFL	LED
			
ENERGY SAVING RATE	30%	80%	90%
LIFE EXPENTANCY	2 YEARS	10 YEARS	22 YEARS
CHARACTERISTIC	BRIGHT	HOT, LIGHT & DULL	BRIGHT

Figure 3: Comparison between Halogen, CFL and LED.
Source: Homebase. Co. UK (2015)

CFL lamp or Compact Fluorescent Lamp use less energy (Watt) compared to fluorescent lamp. (Energy Star, 2015). Malaysia initiated a "Phase-Out" program to replace GLS use with CFL in 2010. According to Brendenkampf (2010), conversion into CFL lamp can help to reduce 75% of energy usage in North Africa. Research shown that occupants of residential buildings believe that using CFL lamps it reduces half of the cost, which is equivalent to 10 fluorescent lamps and 18 watts. According to Brendenkampf (2010), the cost of selling LEDs and CFLs may decrease as the demand for such lighting is high.

3.5 Refrigerator

The energy consumption of the refrigerator contributes 13.4 per cent of the energy used in residential buildings. However, using the energy-efficient type of refrigerator, it saves up to 40% of energy savings (UNDP, 2005). The ambient condition and design of the refrigerator affect the use of electricity. Geppert (2013) found out that energy rises from 2% to 5% when the internal temperature of the refrigerator drops. While the external temperature drops by one degree of Celcius, energy use increase from 6% to 7%. If the temperature rises, energy consumption will also increase. This is because the refrigerator needs more cooling energy. Research by Ghadri and Rasti (2014), shows the heating of the condenser component in the compressor is the cause of increased energy consumption. According to Chunekar (2014), three approaches can reduce energy consumption. This is achieved by using an efficient compressor, switching to high heat and improving ventilation space. The configuration of substances in the refrigerator can have an effect on the rate of energy consumption due to air conduction.

The energy saving rate can be measured in accordance wuth the MSC IEC 62552:2011 Star Index (Suruhanjaya Tenaga, 2015). If the Star Index value shows more than 25%, it proves that the refrigerator is highly efficient.

3.6 Washing Machine

The front cover washing machines saves more energy. This equipment can save up to 80% of the energy as compared to the top cover model. In turn, it also saves 50% of water usage. In addition,time-setting and technology-sensing washing machine allows to determine the quantity limit of washing (Sustainability Victoria, 2015).

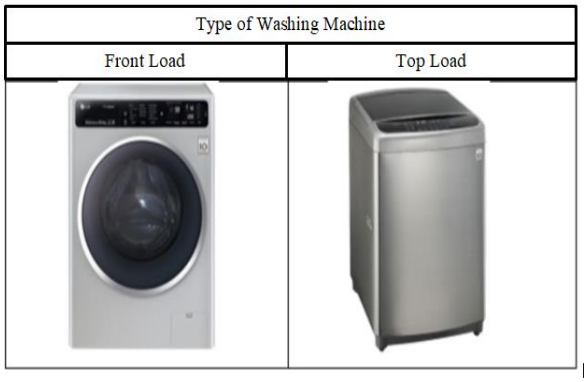

Figure 4: Type of Washing Machine
Source: LG Life's Good.com (2015)

3.7 Energy Saving Practice

Each person has a significant role to play in one society. Changes in lifestyles will help to improve the environment around them. Individuals need to be more concerned with their surroundings.

There must be some successful strategies to share the knowledge and information on how to save the energy across the world. Such campaigns can be performed without high cost and complexity. Costs are an important part of energy savings. This is because people today need more resources because their cost of living is rising. (Steg, 2008).

The next strategy is coordination between two sides, the industry (the information receiver) and the government sector (the delivery of information). Linden *el al*. (2006) clarifies that government sector should provide information on how to save energy while industry needs to decide on government's sector strategies. Gyberg and Palm (2009), states that the improvement in every practice relies on the human choice, since human beings have a right to their own actions. Steg and Vlek (2009), clarify there are three reasons for adapting behaviors to the environment, such as cost factor, context and actions. Motivation factor is cost factor, awareness level and behavior. Nevertheless, the cognitive element comes from the facility dimension, which is equipment and product planning. The third factor is behavior. It depends on the behavior of the community itself.

An example of good practice in daily routine is to set the temperature of the air conditioner at 24 degrees Celcius (Energy.gov, 2015). According to NRDC (2015), energy saving can be approach by a few steps:

Table 1: Energy Saving Approaches

Energy Saving Approaches
• Turn off any electrical equipment when it is not in use and US $150 can be saved. • Do use natural lighting. If not in use, open the window and shut off the light. • Use the natural air of ventilation. • Always close the refrigerator and keep the temperature between 3 to 5 degrees Celcius.

4.0 RESEARCH METHODOLOGY

A few of the methods used to determine residential awareness of energy savings in Setia Alam. This method involves the distribution of the questionnaire form to the Setia Alam residential community. All questionnaire forms containing clear and understandable questions be distributed to the residential.

In addition, the other methods used in this study are Cross Table Analysis and Descriptive Analysis (Frequency Analysis and Likert Scale).

4.1 The Design of Questionnaire Form

The questionnaire was set up to achieve the objectives of this study. This is to identify the awareness of respondents about energy saving practice. There are three sections in the questionnaire. It consists of Section A: Respondents' Background, Section B: The Implementation of Energy Saving among Respondents in Setia Alam and Section C: Energy Saving Practice in daily routine. The questionnaire sample can be found in the Appendix section.

Section A of the questionnaire is to classify the background of the respondents. This is to identify the different groups and profiles of the respondents who respond to the questionnaire. For example, these sections provide the information on gender, age, level of education, occupation, type of property, average energy use and the sum of electrical bills per month.

In Section B, respondents will provide information on the implementation of energy saving practice in Setia Alam. This section helps to evaluate the knowledge and awareness among respondents about the energy saving issues in their living area.

Section C includes questions on how the respondents saving energy in their homes. This is to identify the behaviors of respondents using energy in their house.

4.2 Taro Yamane Formula

Taro Yamane formula (Polonia, 2013) is used to determine the total number of respondents to answer the questionnaire in Setia Alam. It needs a specific formula to determine the number of respondents. The formula used is as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where :
n = sample size
N= population size
e = sample error

This research requires 100 respondents and has randomly chosen to respond to the questionnaire form.

4.3 Cross-Table Analysis

The cross-table analysis is used to find a comparison of two variables or parameters. For example, two variables will be used to evaluate the background of respondents and energy saving practices among respondents.

4.4 Descriptive Analysis

Descriptive Analysis consists of two techniques used in this analysis. The techniques used are Frequency Analysis and by using Likert Scale Analysis.

4.5 Frequency Analysis

Frequency Analysis is used to clearly identify the profile of respondents. This analysis was carried out in order to determine the number of choices chosen by the respondents.

Frequency Analysis, for example, helps to determine the number of responses chosen by two types of gender, male or female. It will show the majority of the responds that answer the questionnaire for each section.

4.6 Likert Scale Analysis

Likert Scale Analysis applied in this study. Likert scale shows the different scale rates. It will be expressed in a number format and respondents need to choose which one of the scales is suitable for them.

The example of Likert Scale used in questionnaire form is as follows:

Table 2: Likert Scale Range

Preference Scale	Measurement
Rarely	1
Often	2
Not sure	3
Usually	4
Always	5

In order to analyze the data using Likert Scale, a few formulas are needed to know the results. Here are a few formulas use to analyze the data using Likert Scale.

Formula to determine the total score:

$$\textbf{Total Score} = \Sigma \textbf{ (Score x frequency score)}$$

Formula for calculating the mean score:

$$\textbf{Mean score:} \quad \frac{\textbf{Total Score}}{\textbf{Total of Respondents}}$$

5.0 Scope of Study

The study area is located in Shah Alam Selangor. This area is known as eco-friendly or energy efficient development area. Setia Alam is located 22.8 km from the town of Shah Alam and is part of the development of the SP Setia project. Setia Alam consists of both residential and commercial buildings. There are some fascinating features of Setia Alam.

The development in Setia Alam focuses on green landscape. Each house in Setia Alam has a green leisure park and a pavement. This area is known as "Green Fingers". There is a special pavement that connects the security guards between the residential areas. The purpose of this special pavement is to reduce the usage of motorcycle around the Setia Alam. Additionally, it also can reduce the emission of carbon in the area.

The architecture of each building in Setia Alam uses an eco-friendly model. Some of the residential buildings are being built with solar panels for energy savings and got water heating purposes. All windows designed with wide size for better natural ventilation. The area between the kitchen and the living room does not have a wall. This is to allow for a better lighting of the room.

In Setia Alam, all the drainage systems are made in compliance with the Urban Storm Water Management Manual for Malaysia (MSMA). The concrete drainage was replaced with water flow which designed according to by the water flow,

which was constructed according to specific engineering, land trench and reservoir.

There are a few facilities in Setia Alam, Setia City Mall and SP Headquarters. Setia City Mall has won a couple of awards for energy efficiency. The awards are the *Green Building Index Silver Award and the Singapore Building and Constructive Authority Green Mark Gold Award* (Tan, 2013) In addition, Setia Alam had won the *Best Masterplan Award* too.

6.0 RESULTS OF QUESTIONNAIRE, CROSS TABLE ANALYSIS AND DESCRIPTIVE ANALYSIS OF ENERGY SAVING IN SETIA ALAM.

The results below show the level of practice on energy savings among the Setia Alam community. Each variable under each of Sections A, B and C in the questionnaire form shows the results of energy saving practice in Setia Alam.

6.1 Frequency Analysis Result of Respondents' Background

All respondents were chosen at random. The results show that 36% of respondents are male and 64% of respondents are female. In addition, these respondents are shoppers who came to the Setia City Mall to shop for their belongings. Some of the respondents came from those who walked around Setia City Park. This is because Setia City Mall and Setia City Park are the main attractions for the Setia Alam community.

6.2 Frequency Analysis Result of Respondents' Race and Age

According to respondents' ethnic group, the majority of respondents are Malay 64%, led by Chinese 20%, Indian 14% and other races are approximately 2%.

Most of the respondents who respond more to the energy savings questionnaire are respondents aged 36-40 years old. This age range of respondents is more responsive than the rest. It was followed by respondents 21-25 years of age, which is 17.6%. The less responsive respondents are aged 51-55 years of age and 56 years of age and above. Below are the results of the respondents' age who response toward this study:

Table 3: Results of Respondents' Age

Age Range (years)	Percentage (%)
21-25	17.6
26-30	16.5
31-35	22.0
36-40	24.2
41-45	12.1
46-50	5.5
51-56	1
56 and above	1
Total	100

6.3 Frequency Analysis Result of Respondents' Occupation and Monthly Income

The majority of respondents work in the private sector, while the lower percentages of respondents who respond to this study are pensioners. The outcome is shown in the table below:

Table 4: Results of Respondents' Occupation and Monthly Income

Occupation	Percentage (%)
Government Sector	14.3
Private Sector	47.3
Pensioners	3.3
Unemployed	35.2
Total	100%

Approximately 39 respondents earned less than RM2,000.00 per month. This is because most of the respondents are a full-time housewife and some of them are students. The household consists of 4 to 6 individuals live under one roof. Below are the findings of the monthly income of the respondents.

Table 5: Monthly income of the respondents

Monthly Income	Frequency	Percentage (%)
<RM2,000	39	42.9
RM2,001-RM3,000	4	4.4
RM3,001-RM4,000	26	28.6
RM4,001-RM5,000	11	12.1
>RM5,001	11	12.1
Total	91	100

6.4 Frequency Analysis Results: Type of Property and Average Use of Energy

Next, the results show that 73.6% respondents lived on landed type of property. However, about 26.14% respondents lived on strata type of property. The table below shows the results of respondents' type of property.

Table 6: Type of Property

Type of Property	Frequency	Percentage (%)
Landed Property	67	73.6
Strata Property	24	26.4
Total	91	100

In addition, the results of the average energy consumption among respondents were analysed in this section. The longest electrical use among the respondents is approximately 13 to 18 hours. The results show that respondents do not generally spend most of their time in their house. Respondents work during the day and only stay at home during the night. Moreover, during the weekend, respondents are doing outdoor recreation.

Table 7: Average of Energy Use by Respondents

Average of Energy Use (hours)	Frequency	Percentage (%)
1 – 6	8	8.8
7 – 12	24	26.4
13 – 18	40	44.0
19 - 24	19	20.9
Total	91	100

7.0 CROSS-TABLE ANALYSIS RESULTS OF OCCUPATION AND MONTHLY INCOME TOWARD ENERGY SAVING PRACTICE

Cross-Table Analysis is used to get the feedback from the respondents about energy saving practice. The purpose of this analysis is to evaluate the relationship between the respondents' background and the knowledge about energy saving.

7.1 The Relationship between Respondents' Occupation and Knowledge of Energy Saving

The findings show that most of the respondents who work in private sector had awareness of energy savings in Setia Alam. Meanwhile, the second majority of the respondents are unemployed. Most of them are full-time housewives. This is because full-time housewives are more concern about energy savings. The table below shows the results by using Cross-Table Analysis.

Table 8: Relationship between the Respondents' Occupation and Knowledge of Energy Saving Practice

	Knowledge of Energy Savings		Total
Occupation	**YES**	**NO**	
Government Sector	13	0	13
	14.3%	0.0%	14.3%
Private Sector	42	1	43
	46.2%	1.1%	47.3%
Pensioners	3	0	3
	3.3%	0.0%	3.3%
Unemployed	31	1	32
	34.1%	1.1%	35.2%
Total	89	2	91
	97.8%	2.2%	100%

7.2 The Relationship between the Respondents' Monthly Income and Knowledge of Energy Savings Practice

Results show that about 39 respondents with income less than RM2,000.00 do have the knowledge about energy savings. To conclude, most of the respondents who unemployed and earned less than RM2,000.00, they do know about energy savings practice. In addition, respondents who earned less income needs to save more in order to avoid excessive energy use and this will increase their electricity bills.

7.3 Knowledge, Practice and Purpose of Energy Savings

In this section, the pattern and the level of knowledge, practice and the purpose of energy savings will be discussed. The practice of energy

savings and awareness among respondents will be analysed to measure knowledge on carbon emissions due to energy use. In addition, the results help to determine the level of knowledge of respondents and their awareness of environment issue.

7.4 Green Lifestyle Practices

About 73 respondents were concerned about environmental issues and they have knowledge about carbon emission from energy use. In addition, Shah Alam took initiatives to become a low-carbon city in 2030. Most of the respondents practice green lifestyles, but about 35 respondents do not practice green lifestyles. Setia Alam has always organized environmental campaigns to protect the environment and most of the community is asking for such an event. In conclusion, among the respondents, they know the importance of protecting the environment. Respondents have made some efforts to protect the environment.

7.5 Knowledge and Practice of Energy Savings

According to the results, 89 of the respondents were aware of the practice of energy savings. Meanwhile, only 2 respondents do not know about the practice of energy savings. Although most of the respondents are aware of energy savings practices, they do not apply this practice in their routine lives. The table below shows the result of energy savings practice among the respondents.

Table 9: Knowledge and Practice of Energy Savings

No.	Knowledge and Practice of Energy Savings	Quantity
1.	Have the knowledge and do practice it	86
2.	Have the knowledge but do not practice it	3
3.	Do not have the knowledge and not practice it	2

The results of the findings are positive. This means that the residence of Setia Alam is concerned about the practice of energy savings. This practice can be performed at different ages of human being.

7.6 Purpose of Energy Savings

There are a few of energy-saving purposes, for example, due to global warming issues, local authority guideline and policy, campaign organized by certain organisation and the reduction of electricity bills. Most of the respondents consent about the purposes of energy savings practice. The following table shows the purpose of the respondents to practice energy savings.

Most of the respondents agree that the purpose of saving energy is more likely to be a campaign program, to avoid global warming and to reduce electricity bills. As a conclusion, the results explain that respondents of Setia Alam have high awareness toward energy saving practice. In addition, the community in Setia Alam contribute a lot of efforts in saving energy.

7.7 Knowledge of Energy Saving Labelling Existence

Here are the findings of the respondents' awareness on energy saving labelling.

Table 10: Knowledge of Energy Saving Labelling Existence

Level of Knowledge	Frequency
YES	72
NO	14
Total	86

The findings of the study indicate that about 72 respondents know that some equipment has an energy-saving label, but 14 respondents do not know that the equipment label has an energy-saving label. In saving energy, respondents who have knowledge of this use energy-saving label equipment in their home. The figure below shows the frequency of respondents practice energy saving.

Among the 70 respondents who use energy saving equipment, they use a power strip in their home. During data collection, some of the respondents do not have knowledge about power strip and they do ask about power strip. Nearly 49 respondents use the front load type of the washing

machine compared to the top load type. Washing machine with front load is always the first option because it can save more energy and reduce excess water.

Next, 52 respondents used LED and CFL type of lamps. This shows that LED and CFL usage is popular among the respondents.

28 respondents concern about EER when using air conditioner. Meanwhile, some of the respondents do not use air conditioner in their home. 27 of the respondents are concern about star index of their refrigerator. Some of the respondents do not know about star index labelling. Respondents will buy a refrigerator that has energy saving labelling. The other respondents, roughly 43 persons choose to purchase refrigerator by size for ventilation purpose.

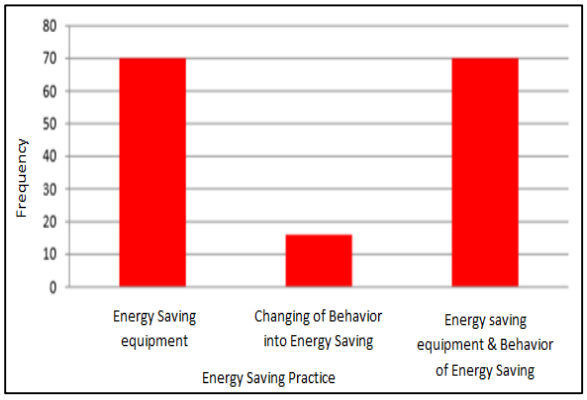

Figure 5: Frequency of respondents practice energy saving
Source: Researcher's study (2016)

7.8 Changing toward Energy Saving Practice

In order to evaluate the change in behaviour towards energy saving practice, the opinion of the respondents needs to be taken.

Energy consumption practice has the highest mean score which is 4.73. Most of the respondents are using natural lighting such as Sun to complete their activity.

The mean score for drying cloth under the Sun is 4.4. The third habits is switch off any electrical equipment when not in use. This habit is easily done by the respondents. The next habit is to relocate the refrigerator away from heat sources. This is to reduce excessive heat of the refrigerator and for a safety reason.

There are a few energy saving campaigns been carried out in Malaysia. The most popular campaign is Earth Hour campaign. People need to switch off any electrical equipment for an hour. Mean score for Earth Hour campaign is 3.53.

8.0 DISCUSSION

As a result, energy saving practice varies from one person to another person. Nevertheless, practice energy savings can have a positive impact on the citizens of Setia Alam. It also helps to protect the atmosphere and our environment.

8.1 Respondents' Background, Race, Age, Occupation and Monthly Income

The majority of residents living in Setia Alam are Malay, Chinese and other races. Many unemployed and students under 40 years old of age are giving good respond toward this study. Most of the residents who are employers work at private sector. According to these residents, they spend at average range between 13 to 18 hours on electricity. The residents who are working usually spend most of their time at working place except on weekends. On weekend, the residents tend to do outdoor activities with their family. The residents earned less than RM2000.00 per month. That is because most of the respondents are among full-time wives and students.

8.2 Knowledge, Practice and Purpose of Energy Savings

Most of the residents in Setia Alam have knowledge of energy savings. However, only minority of them do not know about power strips and star index labelling. They have knowledge but only a minority of them have not practiced energy savings. Residents practice energy savings because they want to reduce electricity bills. Meanwhile, some of the residents realize that energy saving will help to reduce global warming issues. In addition, the guidance and policy prepared by local authorities is one of the alternatives toward energy saving among the residents of Setia Alam.

8.3 Changing toward Energy Saving Practice

Instead of understanding the purpose of saving energy, people need to change their habit to practice saving energy in their daily lives. This is because, with the awareness they have, it will help residents practice energy saving as their essential behaviours.

There are a few alternatives toward energy saving practice. Residents are trying to reduce their energy use by ironing more clothes at one time. Next, residents should turn off the electrical equipment when not in use. In addition, they prefer natural lighting and ventilation to reduce energy usage in their home.

Most of the residents do learn about the star index and energy saving label. While they are purchasing some electrical equipment, they may point to a label that displays energy saving. By relocating the electrical equipment from heat sources also will help to reduce energy use.

9.0 CONCLUSION

According to the study that has been carried out, there is still a lack of concern about environmental issues. Most of the residents in Setia Alam practice a green lifestyle and participate in a number of campaigns. However, all the campaigns are about the issues of recycling. None of the campaign is about the practice of saving energy.

Most parties also participate in the coordination of the energy saving campaign. A lot of efforts and alternative done by Local Authority to help the residents in practicing energy saving.

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APPENDIX A

List of questions for each variable.

Section A: RESPONDENT BACKGROUND

1. **Sex** : ☐ MALE ☐ FEMALE

2. **Race** : ☐ MALAY ☐ INDIAN ☐ CHINESE ☐ OTHERS :

3. **Age** : ☐ 21 - 25 ☐ 26 - 30 ☐ 31 - 35 ☐ 36 - 40 ☐ 41 - 45 ☐ 46 - 50 ☐ 51 - 55 ☐ 56 and above

4. **Occupation** : ☐ Government Sector ☐ Private Sector ☐ Pensioner ☐ Unemployed

5. **Monthly Income** : ☐ < RM2.000.00 ☐ RM2.001 – RM3.000 ☐ RM3.001 – RM4.000 ☐ RM4.001 – RM5.000 ☐ >RM5.001

6. **Type of House** : ☐ Terrace, Bungalow, Semi-D ☐ Flat, Apartment, Condominium

7. **Average energy spent per day** : ☐ 1 – 6 hours ☐ 7 – 12 hours ☐ 13 – 18 hours ☐ 19 – 24 hours

APPENDIX B

Section B : **The Implementation of Energy Saving in Research Location**

Circle **YES** if you **AGREE** and circle **NO** if you **DISAGREE**

B1	Are you concern about the issue of environment?	**YES**	**NO**
B2	Did you practice a green lifestyle in your daily routine?	**YES**	**NO**
B3	Did you know that energy consumption may lead to carbon emission?	**YES**	**NO**
B4	Do you have the knowledge about energy saving practice?	**YES**	**NO**
B5	Do you practice energy saving lifestyle?	**YES**	**NO**
B6	Are you practicing energy saving lifestyle because you know about global warming issue?	**YES**	**NO**
B7	Are you practicing energy saving lifestyle because of the policy, law and guideline from local authority?	**YES**	**NO**
B8	Do you practicing energy saving lifestyle because of certain campaign organized by others party?	**YES**	**NO**
B9	Do you practicing energy saving lifestyle to reduce the electricity bill?	**YES**	**NO**
B10	Do you use any energy saving technology equipment?	**YES**	**NO**
B11	Do you know any of energy saving labelling on your electric equipment? (5 Star, Energy Star, Energy Rating)	**YES**	**NO**
B12	Do you concern about the energy saving labelling when purchasing any electric equipment?	**YES**	**NO**
B13	Do you own any equipment which have the energy saving labelling?	**YES**	**NO**
B14	Do you use any power strip in your house?	**YES**	**NO**
B15	Do you use washing machine with front door compare to upper door type of washing machine?	**YES**	**NO**
B16	Do you use any energy saving type of lamps such as LED or CFL in your house?	**YES**	**NO**
B17	Do you concern about **Energy Effective Ration (EER)** when purchasing the air conditioner?	**YES**	**NO**
B18	Do you concern about the '**Star Index'** labelling when purchasing the refrigerator?	**YES**	**NO**
B19	Do you purchase a refrigerator according to the size for good ventilation in the refrigerator?	**YES**	**NO**
B20	Do you change your energy saving habit in your own house? (For example, switch off the lamp when not using it)	**YES**	**NO**

APPENDIX C

SECTION C : ENERGY SAVING PRACTICE

According to Likert Scale below, please tick one answer for each question.

Rarely	Often	Not sure	Usually	Always
1	2	3	4	5

C1	Use natural lighting from outdoor instead of switch on the lamps	1	2	3	4	5
C2	Use natural ventilation or fan to cool down the space	1	2	3	4	5
C3	Use air conditioner in certain time only (night time or during hot weather)	1	2	3	4	5
C4	Set up the temperature of air conditioner at 24 degree Celcius	1	2	3	4	5
C5	Temperature of refrigerator around 3 to 5 degree Celcius	1	2	3	4	5
C6	Relocate refrigerator avoiding heating source to reduce the energy saving consumption	1	2	3	4	5
C7	Switch off any electric equipment when not using it	1	2	3	4	5
C8	Do maintenance and cleaning on air conditioner	1	2	3	4	5
C9	Use maximum space when cleaning cloth using washing machine	1	2	3	4	5
C10	Use cold water to wash the cloth instead of using hot water	1	2	3	4	5
C11	Dry the cloth under the natural lighting instead of using dryer	1	2	3	4	5
C12	Switch laptop or desktop equipment into Sleep Mode or Standby Mode	1	2	3	4	5
C13	Fill in the heater with maximum volume of water	1	2	3	4	5
C14	Iron the clothes in abundance quantity to avoid too much energy consumption	1	2	3	4	5
C15	Getting involve in Earth Hour campaign	1	2	3	4	5