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Article

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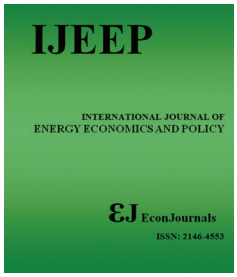

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Strategy in Energy Efficiency Management: University Campus

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ABSTRACT

Concerns on the effects of climate change have encouraged efforts to lowering energy consumption and implementing energy management. With the application of energy management, it could help in reducing energy consumption and conserving depleting energy resources categorized as non-renewable energy that humans greatly depend on. The aims of the study are: (i) To analyze the main elements that contribute toward the increasing pattern of energy consumption in Universiti Utara Malaysia, and (ii) to determine the energy efficiency strategies that are suitable to reduce electricity consumption in Universiti Utara Malaysia. Th data used for this research consisted of primary and secondary data. Primary data was collected from expert interviews, while secondary data derived from electronic sources and books. Findings of this research pointed out that by implementing sustainable strategies and policy, it could help Universiti Utara Malaysia undergo energy management and aim to reduce overall energy consumption in the campus.

Keywords: Energy Efficiency, Energy Management, Sustainable, University Building
JEL Classifications: Q43, Q48

INTRODUCTION

Energy related issues had become a trending and highly concern issue lately especially energy efficiency. Energy efficiency means using less energy to provide the same service (Clark, 2012). Energy efficiency is very important due to the escalating energy cost and continuously depleting energy resources (Qi Jie Kwonga, 2018). With high energy efficiency, energy cost can be reduced and help to conserve energy resources that are depleting, especially non-renewable energy.

Energy efficiency had become a major issue concerned by a lot of companies involves both public and private sector. University buildings are high consumers of energy in the category of commercial buildings due to its activities and population (Najihah, 2013). Therefore, it is very important for university to take this issue seriously and practice a good energy management. For example, Universiti Teknologi Malaysia (UTM) is able to save 21 million kWh since the launching of the UTM Sustainable Energy Management Program from the year 2011, or a total monetary savings of RM6.6 million between the year 2011 and 2013 (About Us: UTM Energy Management, 2018).

Energy management, as a cornerstone in achieving energy efficiency, has been under some of that spotlight throughout the media (Ruiz, 2015). Many universities around the world had taken this issue seriously and had already implement a lot of energy management plan and strategies to help achieve energy efficiency. For example, Universiti Teknologi Malaysia (UTM) launched Sustainability Energy Management Program as their effort to become an energy efficiency university (About Us: UTM Energy Management, 2018). Universiti Utara Malaysia (UUM) is one of the publicuniversity in Malaysia. Since it is a university, it requires a lot of energy in order to carry out daily operations such as lecture

and also commodity for the students and lectures in the campus. In 2017, the total energy consumption for the whole campus of UUM is 44,294,706kWh. The continued growth in the campus demand for energy and the University's need for an affordable, reliable supply of energy presents the opportunity for Facilities Management to implement new energy preserve plan and strategies (Energy Conservation and Management Strategic Plan, 2007).

Electrical energy is required to carry out basic activities in UUM. Since UUM is an university that have a lot of buildings and facilities, it will results in UUM consume high level of electrical energy. Even though the consumption of electricity by UUM over the past few years has showed a slight reduction, however the usage and cost for electricity is still relatively high when compared to other local universities. The main factor for this problem is due to the lack of knowledge and strategies on effective energy management by authority. A survey performed in Malaysian universities reveals that the level of energy awareness and energy usage behaviour among the university community is poor (Choong and Chong, 2012). This means that most of the participant in the university are not aware that the level of energy usage used by the university.

There are many factors that contributed to the high energy consumption in UUM. Before taking any relative action, it is important to understand what factors explain the electricity consumption and how to minimise or reduce it (Huebner and Shipworth, 2016). These factors must be identified in order to help UUM to plan for strategies that are suitable to reduce the energy consumption level and at the same time reduce the total cost of energy for UUM. Without understanding the factors, it will be difficult for UUM to determine what should be done in order for UUM to reduce energy consumption and hence achieve an energy efficiency university status.

To overcome high energy usage and become energy efficient, it is very important for authority of UUM to carry out strategies and activities that will help to overcome this problem because energy efficiency will have long-term benefits such as reduced uncertainty from fluctuating energy prices, leading to overall cost savings and reduced environmental impact (Alison, 2006) Even though is a challenge for UUM. This is because energy management is still remains a step-child with few organizations implementing a formal energy management system (Michael Brown).

This paper aims to identify the strategies that reduce high energy consumption and enable UUM to become an energy efficient university.

2. METHODOLOGY

Qualitative model approach is a process of naturalistic inquiry that seeks in-depth understanding of social phenomena within their natural setting. It focuses on the "why" rather than the "what" of social phenomena and relies on the direct experiences of human beings as meaning-making agents in their everyday lives (Miles and Hunter, 1984). For this project, the purpose of the study is to understand what are the main factors that contribute to the high energy consumption in UUM and what are the strategies that can be implemented to help UUM to become an energy efficiency university. To learn more about the factors that contribute to high energy consumption and strategies that can be implemented to become an energy efficiency university, it is very important to collect data. In order to collect data, the best-known way is through interview and it is the most suitable for theory building. Individual Depth Interviews (IDI) is one of the qualitative approach techniques used to collect data. The questions asked during interview will help researcher to have greater knowledge and information on the topic that is being studied. For this study, the interview session is conducted through interviewing with the head of department of energy department in UUM, Mr Radzaini. Mr. Radzaini is chosen as the interviewee due to his position and role in the electricity department as he will provide useful and reliable information and data regarding the energy consumption and energy related topic in UUM.

This section provides the data regarding the electricity consumption in UUM campus buildings that were obtained from Jabatan Pembangunan and Penyenggaraan (JPP) (Development and Maintenance Department). These data covered each sector of buildings in UUM for the year 2018. The Building Energy Index (BEI) was calculated using Equation (1). According to the MS1525 standard, the recommended BEI in Malaysia is 135 kWh/m^2/year.

EEI=(Total Electricity Consumption)/(Gross floor area) (1)

3. RESULTS

3.1. Office Buildings in UUM

As can be seen from Table 1, among the office buildings, Chancellery held the highest electricity usage as compared to JPP and Bangunan Keselamatan. The Chancellery building is known as the iconic main office building that is used as the administration office and is located in the central area of the UUM campus. This 27-year-old building with six stories covers a gross area of 8983 m^2 (Tahir et al., 2017). With these huge areas, it is obvious that the electricity consumption is high, followed by the operation hours from 7.45 a.m. to 5.30 p.m. Masjid Sultan Badlishah also greatly contributes toward the electricity consumption in UUM Campus as the mosque is operating all day and available at any time. JPP and Masjid Sultan Bahiyah achieved 5 stars based on the BEI index calculation.

Table 1: Office Buildings Total Electricity Consumption and Bill on 2018

Building name	Area (m^2)	Electricity Consumption (kWh)	Cost (RM)	Energy Efficiency Index (EEI)	STAR
Chancellery	8965	1651189	840455.2	184.18	2 **
Bangunan Keselamatan	872	439515	2223713	504.03	1*
JPP	5843.93	494824	251865.4	84.67	5*****
Pusat Islam	2212.8	283614	144359.5	128.17	4****
Masjid Sultanah Bahiyah	8794	560181	285132.1	63.70	5*****

3.2. Lecture Halls in UUM

Table 2 provides the data of electricity consumption at lecture halls in the UUM campus. The Accounting Faculty held the highest electricity consumption, followed by FTM/DKG4 and SOIS/DKG7. The Accounting Faculty and FTM/DKG4 are categorized as older buildings as compared to SOIS/DKG7. From the data above, it can be assumed that older buildings with older appliances are less efficient than the newer ones.

3.3. Student Residential Halls

According to Table 3, INASIS Bank Rakyat and INASIS Al-Bukhari consumed a huge amount of electricity in 2018. These two buildings are the biggest student residential hall buildings in the UUM Campus, leading to the buildings consuming a great deal of electricity. As compared to these two residential hall buildings, the electricity consumption of other student residential hall buildings should be lower. However, the stars achieved for both buildings were 5 stars.

3.4. Strategies in Energy Efficiency Management

According to the research objective number two, this research aims to determine the energy efficiency strategies that are suitable to reduce electricity consumption (kWh) and total electric bill (RM) per year. In order to achieve energy efficiency in university campus building, it requires hard work and long journey. The following are the new strategies and policy could be implemented to help Universiti Utara Malaysia undergo the energy management and aim to reduce overall energy consumption per year.

3.4.1. Raising the energy awareness

The first proposed strategy is to raise the energy awareness among the students, lecturers, staffs and other people that linked and doing their activity inside the campus. Awareness is defined in the Dictionary of Psychology as "consciousness, alertness, cognizance of something, a state of knowledge or understanding of environmental or internal events (Corsini, 2002). In order to change the attitude, mindset and behavior of the people that are linked to the university, we have to point out clearly on what is going on now about our environment, energy reserves and other energy related issue. We also need to elaborate the good changes that will happen if we reduce our energy consumption. These changes must be triggered by the awareness of the individuals. Energy awareness can be raised via various channels, such as energy awareness campaigns, distribution of stickers with key messages, newsletters, energy knowledge competitions, campus energy week and any other relevant methods that could raise the community's awareness of energy (Ting et al., 2012).

Table 2: Lecture Halls Total Electricity Consumption and Bill on 2018

Building Name	Area (m^2)	Electricity Consumption (kWh)	Cost (RM)	Energy Efficiency Index (EEI)	Star
Accounting Faculty	10543	1802412	917427.7	170.96	2**
FTM/DKG 4	15026	1316096	669892.9	87.59	5*****
SOIS/DKG 7	10365.66	622676	316942.1	60.07	5*****
STML	6797.4	933050	474910.8	137.27	3***

Table 3: Student Residential Halls' Total Electricity Consumption and Bill in 2018

Building Name	Area (m^2)	Electricity Consumption (kWh)	Cost (RM)	Energy Efficiency Index (EEI)	Star
Bank Rakyat	48548.84	822890	418851	16.94974	5*****
Albukhari	32933.55	780988	397522.9	23.71405	5*****

3.4.2. Gaining top management commitment

Without top management commitment and support, all of the strategies, programs and policies to reduce energy consumption would be futile. Top management needs to approve the proposed strategy or policy and act as the influential and important element to secure the accomplishment of a program. Without appropriate resources and permission, any kind of strategy, program or policy cannot reach the objective successfully. The proactive top management in accessing and support the energy conservation related program will unconsciously attract better participation among the campus communities. Proposed ways to deliver top management commitment to energy conservation programs on campus include the establishment of organizational policies to monitor the whole process, listing in writing the duties and responsibilities of top management in energy conservation, establishing relevant written policies, vision and mission and other relevant initiatives showing commitment to the desired outcomes (Ting et al., 2012).

3.4.3. Developing energy saving guidelines

Developing energy saving guidelines for the students, lecturers, staffs and other people that linked and doing their activity inside the campus is one of the best initiatives that has to be taken. This guideline helps to grow the conservation culture within the campus community. To ensure energy on campus is used efficiently, sufficiently and adequately, the communities that possesses relevant energy conservation knowledge also plays a critical important role (Ting et al., 2012). This energy saving guideline can be elaborated as below:

- Lighting System
  a) Allow the natural light to lighten up the building and minimizing light bulb usage during the day
  b) Switch off lights when not used
  c) Lighting should be focus on the users only
  d) Provide "Energy Saving" label on the light switch
  e) Walls of the buildings should be painted with bright color to avoid light absorption
  f) Use LED light

- Air-conditioning and fan
  a) Optimize the operating hours of air-conditioning
  b) Set the temperature to 24°C to maintain the air-conditioning in the most efficiency state
  c) Close the door and any gap that allow the cold air inside the room does not come out to the outside
  d) Apply scheduled maintenance for the air-conditioning
  e) Apply proper insulation to reduce external heat
  f) Turn off the fan if no one inside the room

- Electronic Appliances
  a) Switch off the electronic appliances if it not been used
  b) Set the computer to sleep or hibernate mode instead of using a screen saver so it uses less electricity during periods of inactivity Use more than 3-star rating energy label electronic appliances
  c) Use a power meter to measure power consumption even at very low power levels. These devices can help to root out the main cause of high electricity usage by electronic devices and identify opportunities for savings
  d) Plug the electronic devices into a power strip (extension) with an on/off switch. This will allow you to turn off all power to the devices in one easy step
  e) Unplug battery chargers when the batteries are fully charged or the chargers are not in use. Many chargers draw power continuously, even when the device is not plugged into the charger

3.4.4. Develop energy conservation behavior

Normally, energy conservation can be differentiated into the structural and non-structural energy conservation. Structural energy conservation refers to the energy conservation achieved via the use of technology or technical instruments, such as the installation of energy efficiency light bulbs and sensors to turn off unused lighting automatically, otherwise the non-structural energy conservation concerns with the behavioral changes to achieve energy reductions (Ting et al., 2012). The development of non-structural energy conservation behavior is more likely to be sustainable, as the habit performed by individuals will be continuously and everywhere, not limited to the campus area only. Therefore, nurturing the students, lecturers, staffs and other people that linked and doing their activity inside the campus has a good potential in reducing the energy consumption. Energy conservation behavior on campus can be developed through various channels, including providing feedback on energy consumption, creating an energy friendly environment, lecturers providing reminders to turn off unnecessary appliances, competition between hostels to reduce energy consumption, recognizing those who actively conserve energy and other relevant activities and tools relevant to the local context (Ting et al., 2012).

4. CONCLUSION

Energy related issues are threatening the world's energy sustainability. Various attempts are made by different parties in order to achieve energy efficiency by implementing energy management. With energy management, it could help in reducing energy consumption and conserve the energy resources that are depleting and categorized as non-renewable energy that people are very dependent upon. These energy issues are vital to be considered to secure a better and more sustainable world for future generations to live in. This paper examines the energy consumption trend in Universiti Utara Malaysia as a measurement to assist the university in achieving efficient energy usage on the whole campus. The strategies dealt with raising energy awareness, gaining top management commitment, developing energy saving guidelines, and developing energy conservation behavior among the students, staff, and lecturers. For this study, it is clear that the main issue in contributing toward high energy consumption nonetheless is human-related behaviors and activities.

The strategies and policy would be futile if the lack of awareness in energy related issues are still close within the students, staff, and lecturers in UUM. The researchers hope that UUM could implement more strategies and policies in the future to help the campus become more efficient in terms of energy usage.

5. ACKNOWLEDGMENT

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