The Needs for Raising Energy Awareness and Improving Energy Use Behaviour in Malaysian Public Universities

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ABSTRACT

This paper highlights the rationales for raising students' energy awareness and improving energy-use behaviour in Malaysian public universities. We conducted a study which involved a questionnaire survey covering one hundred and fifty students from three local public universities. Besides, an interview was also conducted among energy managers from two of the universities. The survey indicated that the respondents have a low level of energy awareness and they were engaged in inappropriate energy-use habit. These were corroborated based on the comments made by energy managers that Malaysian public universities need a guideline for raising energy awareness and improving energy-use behaviour. At the moment, there was no energy-use procedure or strategy to refer to. This paper proposes the need for developing a conceptual model of energy awareness development process (CMEADP) for Malaysian universities.

Keywords: Facilities management, energy management, awareness development, energy-use behaviour, sustainable development, education.

1.0 INTRODUCTION

At the beginning of 21st. century, the issues of sky-high energy prices, depreciation of energy resources, environmental disturbance and energy conflicts have reminded people about the needs for a sustainable energy-use. World Commission on Environment and Development (1987) defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Goldemberg *et al*. (2000) have extended and related the definition to energy with two important arguments. Firstly, the importance of adequate energy services for satisfying basic human needs, improving social welfare, and achieving economic development. Secondly, the production and use of energy that should not endanger the quality of life of current and future generations and that does not exceed the carrying capacity of ecosystems. One way to achieve a sustainable energy development is to save energy, to reduce wastage, and to extend the time for the world to resolve energy issues. These are part of energy management.

Energy management is gaining recognition, although it is neither a new term nor a new idea. According to Capehart *et al.* (2006), energy management is the judicious and effective use of energy to maximize profits or minimize costs and enhance competitive positions. Conservation steps taken by businesses – switching off lights, removing lamps from fixtures, reducing night time illumination of facade, signs and advertising offers a practical approach to an ongoing problem in respect of the effective and efficient use of energy resources (Harrold, 1993).

2.0 BEHAVIOURAL APPROACH VS TECHNOLOGY APPROACH

Basically, there are two common approaches to energy management, namely the behavioural approach and the technological approach (Mohon *et al*., 1983; Wong, 1997). The technological approach refers to the application of technology instruments which normally involve large-scale investment. These include introducing a new process, automation system, or installing large energy-saving devices such as heat recovery system, new building design, inverter, pre-heater, motion sensor, and building envelope system. In the technological approach, the payback period is a significant issue. The 'return on investment' must be decided first before implementing any technology. The technological approach is effective in conserving energy and the results can be observed within a short period of time. However, the initial cost of technological approach is high and not suitable for an organization that has a limited budget. Since technological approach requires no behavioural changes among users, it means that a user could still waste energy in the same way. As we develop physical technologies to improve energy efficiencies, we only migrate the effects of energy use by human, not curing the energy problem we are experiencing (Kempton and Schipper, 1994). Using technological approach may seem impressive and attractive. However, it is not the unique answer to achieve energy sustainability. Regardless of the method selected for achieving energy savings, either completes system replacement or modification of an existing system, it is important to consider the human aspect of energy conservation (Shinskey, 1982). Owens (1987) noted that it is people who use energy indeed. It is, therefore, important to consider the human aspect of energy conservation. To encourage and change people's behaviour to conserve energy is, thus, a question of behavioural approach.

The literature in the energy use reveals the vitality of behavioural approach in any energy conservation programme whereby energy use is regarded as a key success factor in energy management (Dahle and Neumayer, 2001; Loozen and Moosdijk, 2001). Compared to the technological approach, the behavioural approach can be effective and can make a significant difference in energy conservation (Wedge, 2003). Experiments have shown that 5-10% of the domestic energy use can be saved by appropriate use behaviour (Loozen and Moosdijk, 2001). This means, by monitoring people's behaviour, there is a great chance to improve energy efficiency. Hansen (2002) mentioned that people is the main factor in energy efficiency. Furthermore, a survey on successful school energy-conservation programs in Tuscon revealed that one of the successful criteria to generate saving is to focus primarily on behavioural changes (Gaballa, 1996). However, facilities managers and plant operators tend to be sceptical about behavioural approaches, and have little understanding about them and their potential (Geller *et al*., 1982). For that reason, they have a tendency not to pay attention to the benefits of behavioural approach.

3.0 AWARENESS: THE SEED FOR TOMORROW'S CHANGE

There are tremendous opportunities in the behavioural approach to energy conservation by engaging users with issues such as attitudes, knowledge, awareness and skills (Vesma, 2002). However, the initial step towards behavioural changes is to raise awareness as it is the seed for tomorrow's changes (Wong, 1997). Without awareness, there will be no realistic action to conserve energy. One noteworthy report had stated that it is important to raise awareness in the energy sector (United Nations Environment Programme, 2007).

Awareness is defined as having knowledge or realizing something (The Microsoft Encarta Dictionary, 2005). Lack of knowledge or awareness is always the key barriers for energy inefficiency (Yik and Lee, 2002; Yik *et al.*, 2002). Dahle and Neumayer (2001) disclosed several influential factors that become a barrier to greening process such as financial, cultural and urbanization. Awareness was the second barrier to the greening process.

Dahle and Neumayer (2001) conclude that behavioural change, and thereby cultural change, cannot be expected to take place unless people are aware to do so. This indicates that people will not take any steps to conserve energy if they are not aware of the importance of energy saving.

In the past, awareness has been promoted as a method to conserve energy in higher learning institutions. For instance, the Imperial College of Science, Technology and Medicine, in London, has defined objectives to focus on raising staff and student awareness about energy conservation issues as a strategy to help protect the environment through more efficient energy use and to save money on fuel bills (Pancucci, 1998).

4.0 THE SIGNIFICANCE OF IMPROVING ENERGY AWARENESS ON CAMPUS

Simpson (1994) has mentioned that energy awareness is an essential ingredient of energy conservation program on campus. It will not succeed if campus community is complacent and taking campus energy use for granted. There are several reasons why raising energy awareness and improving energy-use behaviour in local university are important. Firstly, universities have large number of building users compared to industries and, therefore, human factor is critical to energy saving. Raising energy awareness among students will help them to be more conscientious about energy saving at home, at work and in their life. Secondly, universities have a large number of facilities ranging from classrooms, halls, offices, restaurants, sports centres, libraries, labs, shops, clinics, hostels and other similar facilities. Most of the energy systems embedded in these facilities such as lighting and air-conditioning system are still manually operated and, thus, to recommend ways for students to use it effectively is imperative. Thirdly, since a university is an educational institution, education training on energy saving can be easily implemented. Behavioural improvement is more possible to be implemented among students than among working people. Fourthly, creating energy awareness can yield monetary savings. The typical energy bill in the education sector is approximately 5% of the total expenditure (Keeffe and Grimshaw, 1994). There is a possibility of saving 5- 10% of the energy expenditure through improved energy-use behaviour (Loozen and Moosdijk, 2001). This can be a substantial amount for a university as it is not a single sum, but an annual expenditure. Fifthly, energy saving and being green will enhance the public image of the university.

This research attempts to find out the level of energy awareness and energy-use behaviour among students in three Malaysian universities, namely Universiti Teknologi Malaysia (UTM), International Islamic University Malaysia (IIUM) and Universiti Sains Malaysia. Samples of 50 respondents from each university were randomly chosen in the survey.

5.0 RESEARCH METHODOLOGY

To ascertain current energy awareness and energy-use behaviour among students in Malaysian public universities, a questionnaire survey was carried. Besides, interviews with campus energy managers were also conducted as a supplementary source of information for the study.

5.1 Questionnaire Survey

The questionnaire comprised cognition and behavioural sections. The cognition section was designed to measure student's existing energy awareness on some energy knowledge and issues while the behavioural section was designed to measure respondent's energy-use pattern.

The cognition section comprised eight multiple-choice questions on energy awareness evaluation. For each question, respondents were asked to select only one correct out of five answers. One point was given for each correct answer. Besides, there were two questions (9 and 10) concerning student's willingness to participate in energy conservation programme. For these two questions, respondent were required to express their answer as 'yes' or 'no'.

The behavioural section consisted of 10 "evasive" questions to which respondents revealed their peer's energy-conservation behaviour (e.g. "how often do you see people leaving lights on in empty rooms in your university?"). The rationale for such questions was to avoid presumably threatening or blaming questions on respondents (e.g. "how often do you leave lights on in empty rooms in your university?"), that will possibly invite untruthful answers. In this section, respondents were instructed to mark each answer based on the scale as shown in Table 1.

Table 1: Behavioural scales used in the questionnaire survey

1= Never	0 case
2= Rarely	At least once in every six months
3= Occasionally	At least once in every three months
4= Often	At least once in every month
4= Always	At least once in every week

The data collected from the questionnaire survey were summarised into frequency analysis and grouped into categories to indicate the distribution of the results. To reveal the awareness of students towards current energy issues, the gain scores analysis was applied for the cognition section. In this case, the total scores and mean gain scores of groups were compared with each other.

5.2 Interviews

Two key informants who are energy managers from Universiti Teknologi Malaysia (UTM) and International Islamic University Malaysia (IIUM) have been interviewed to supplement the questionnaire survey. Both of them have more than 8 years experience in energy management. An open-ended questionnaire was designed to ascertain their views on students' energy awareness and behaviour in the university.

The questionnaire covered many aspects, such as trends of energy usage in the university, university's annual energy cost, efficiency of the energy usage, student's energy-use pattern, and efforts taken by the university to overcome energy problems and major barriers to achieve energy efficiency in the university.

6.0 RESULTS FROM THE QUESTIONNAIRE SURVEY

The results are presented into cognition and behavioural sections.

6.1 Cognition Section

In the cognition section, the scores for correct answer were low except for question one (Table 2). For question three, only 38 out of 150 (25%) respondents were able to answer the question pertaining to electricity rate. For question six, only one out of 150 (0.7%) respondents was able to answer it correctly. Overall, the respondents have low scores of between 0.7% to 58% for all answers indicating low energy awareness among them.

Table 2: Summary of total gained scores and mean scores for the respondents from three universities (Questions 1 and 8)

Number	Question	Correct Answer	Scores for correct answer (over 150 respondents)	Percentage
1	Nowadays, the sky-high oil price problem at which level?	(D) International Level	87	58%
2	Until today, what is the recent oil price per barrel?	(D) >US 45	40	26.7%
3	How much is the current electricity tariff?	(C) RM0.2-0.3/KWh	38	25.3%
4	What is the current retail consumer price of petrol in Malaysia?	(D) RM1.9-2.0/litter	62	41.3%

Number	Question	Correct Answer	Scores for correct answer (over 150 respondents)	Percentage
5	Which sector is the biggest energy user in Malaysia?	(D) Transportation	10	6.7%
6	What is the main source of energy supply in Malaysia?	(D) Crude oil/Petroleum	1	0.7%
7	What is the major resource for electricity generation in Malaysia?	(B) Natural Gas	21	14%
8	How much do you think the university had spent on electricity annually?	(D) >8million	14	9.3%

In responding to Question 9, majority of the respondents (122 out of 150) stated that there is a need for the university to conserve energy (Table 3). As for Question 10, the proportion of respondents who have expressed their willingness to participate in energy conservation programme was (105 out of 150) = 70%. The findings have disclosed that although students feel the needs to conserve energy at the university, however, they may do not want to contribute in the energy saving activities. It seems that there is a gap in between attitude and behaviour. The following section intends to reveal the energy-use behaviour pattern among them.

Table 3: Summary of answers for the respondents from three universities (Questions 9 and 10)

Number	Question	Yes	No
9	Do you see any needs for local university to conserve energy?	81%	19%
10	If given the chances, would you be interested to participate in any energy conservation program in University?	70%	30%

6.2 Behavioural Section

The results showed that the university students did not have appropriate energy-use behaviour. Based on the answers to questions 11 to 13, the respondents appeared to be unapprehensive about energy problems. The majority of them said that they occasionally and rarely conserved energy or discussed energy issues with their peers. Also, as many as 104 out of 150 (69.3%) respondents stated that they had never attended any energy awareness campaign.

The survey also revealed that 61% of the respondents have confronted people who left lights in inside unoccupied rooms. About 28% of the respondents confessed that they occasionally saw other people leaving lights on without use.

The energy conservation issues regarding air conditioning system were asked in three different questions. The first question is about whether respondents confronted other people leaving air conditioning system on for empty rooms, 29% and 26% of the respondent said they often and always confronted such scenario. Question two asked whether the air conditioning system was operated to the overcooling temperature. In this case, many of them select occasionally (30%) and often (29%). In Question three, most of the respondents said they occasionally (31%) see people operate air conditioning system in the setting where door and window remained open.

With regard to the computer issue, 36% of the respondents stated that they always saw people leaving computer on even there is no one using it. It was also found that 42% of the respondents had always confronted other people using heavy electricity consumptions equipment such as kettle, television and iron in the hostel. All of these revealed that there is a need to improve energy awareness and energy-use behaviour of students in local universities. The following section intends to confirm the needs through university energy manager's perspectives.

7.0 RESULTS FROM THE INTERVIEW

Both energy managers agreed that the local university nowadays face serious energy wastage problems on top of about ten million ringgit of annual energy cost. This imposes a heavy burden on the university.

According to the energy manager from UTM, students' "take energy for granted" behaviour is the main factor that contributes to unnecessarily high energy cost. He gave examples of students not switching off lights when not using them; air conditioning systems that often operate to the overcooling temperature; and heavy use of electricity equipments in hostels, including television and electric kettle. The wiring systems in hostels are not designed to sustain heavy electricity loads and easily heat in such a situation. This can cause electricity failure and energy inefficiency in the form of electricity heat loss.

The energy manager from IIUM gave the same opinion. He commented that energy wastage in IIUM is partially associated with students' low awareness and non-appreciating behaviour with regards to energy use. Both of managers believed that improving students' energy use awareness and behaviour would reduce unnecessary energy cost and increase energy efficiency.

Most of the electric appliances in university such as lights, computers, air conditioning system, washing machines, and televisions are manually operated. Therefore, use efficiency can be improved through change in awareness, in particular, and change in behaviour, in general. Although both of them realized that students' inefficiency of energy-use is the reason for the situation, no appropriate actions had been taken by the university. This is because there are no guidelines on how to raise energy awareness and improve energy use behaviour.

The interview also revealed that both mangers believed that technology and human behaviours can significantly influence energy consumption. Since maintenance budget is limited, application of high technology equipments and energy awareness are critical as one of the methods for conserving energy in the Malaysian universities. Technology is not the only criterion that should be given consideration in energy-saving strategies, but also the human factor. This is where university can lead in the development of creative human resource and technology in line with the aspiration of the nation.

8.0 CONCLUSION

The survey results indicated that Malaysian university students do not have appropriate energy awareness and were engaged in inappropriate energy-use habit. These were corroborated by energy manager in the same institution who perceived that student's inappropriate energy-use behaviour as one of the reasons that had contributed to expensive energy cost. Therefore, it is important to develop a guideline in helping facilities managers or energy managers to conserve energy through awareness development and behavioural improvement approach. This research recommends that a conceptual model of energy awareness development process be developed in a future study. The model will serve as the guidelines for raising energy awareness and improving energy-use behaviour among university students (Choong, 2008).

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