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A Study of Factors which Influence Energy Efficiency in Medium-Sized Hotels: A Case of a Four-Star Hotel in Kuala Lumpur

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Abstract

The main objective of this research is to determine the internal and external factors of a four-star hotel in Kuala Lumpur that influence its energy conservation. The relationship between the energy consumption versus the number of guest night is also being studied. The findings indicate that there is a significant relationship between the electricity consumption and the number of guest night, and between the water consumption and the number of guest night. No significant relationship between the gas consumption and the number of guest night is found. The findings of this research will benefit other medium-sized hotels that may want to start up with an energy conservation plan as the hospitality industry is now going towards a more environmental conscious trend. In order to be energy efficient in daily operations for medium-sized hotels, it is important that these establishments to look into all factors that are illustrated in the conceptual framework. The researcher also provides the four-star hotel a number of recommendations for further improvement and suggests some relevant areas to be included for future studies.

Keywords: Internal and External Factors; Energy Conservation; Energy Efficiency; Medium-Sized Hotels; Four-Star Hotel

Introduction

According to McGraw-Hill (2007), energy conservation is the management of the human use of natural resources to provide the maximum benefit to the current generation while maintaining capacity to meet the needs of the future generation. Conservation includes both the protection and rational use of natural resources. The initial approach of energy conservation was to consume less energy. However, with the development of human's intelligence, it is slowly changed to the concept of getting work done with minimal energy used while not affecting the result. This is known as energy efficiency. Energy conservation is a practice through the assistance of the technology advancement, including the improvement of the technical aspect in new equipment, systems, architecture and transportation (McGraw-Hill, 2007).

Problem Statement

Energy conservation in the hospitality industry is to minimize the energy use during operation without compromising safety, security and ensuring the standards and quality of the product and services are maintained. The benefits of an energy efficient hotel include greater guest comfort, extended life of equipment, lower operating costs, a cleaner environment and significant financial rewards.

Among the incentives which would encourage hoteliers to undertake environmentally-oriented initiatives in their hotels, the possibility of reducing operational costs is the most commonly emphasized. Customer demand comes in second position, and the desire to improve the hotel's image comes in third (Hotel Energy Solutions, 2011).

Hotel Energy Solutions (2011) also stated that the incorporation of environmental measures as part of company policy was more common among large hotel corporations than among individual hotels, where the implementation of these measures still represents a major challenge for small and medium-sized enterprises.

Ever since the "going green" trend is going on all over the world, there are also easy accesses to the many best practices available. Thus, when planning for an energy conservation plan, it is important to be attentive enough to consider all the influencing factors and modification of existing practices is necessary to suit the hotel circumstances to achieve the finest result.

Research Objectives

The research objectives are listed in the following:

1. To identify the internal and external factors of a four-star hotel in Kuala Lumpur that lead to its energy conservation.
2. To determine the relationship between the energy consumption versus the number of guests per night.

Theoretical and Conceptual Framework

There are internal and external factors that will influence the energy consumption in a hotel (Tousaint, 1994).

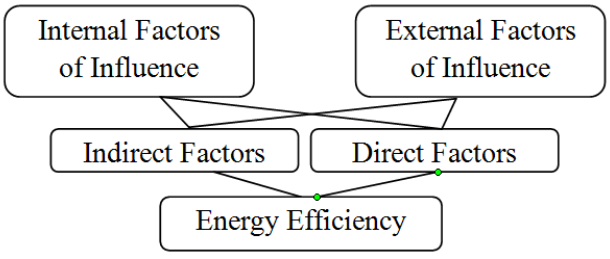

Figure 1.1: The Qualitative Theoretical Framework
Source: Adopted & adapted from Tousaint (1994)

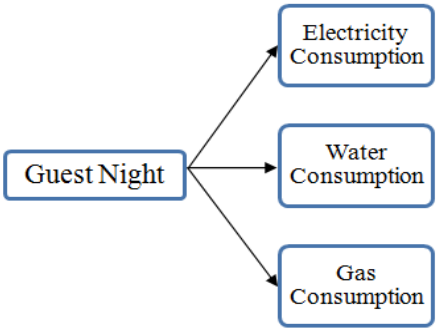

Figure 1.2: The Quantitative Theoretical Framework
Source: Adopted & adapted from Bohdanowicz and Martinac (2007)

The Internal Factors of Influence

According to Tousaint (1994), the internal factors of influence can be further divided into direct and indirect factors of influence on energy efficiency.

Table 1.1: *Internal Factors of Influence*	
Direct Factors of Influence	Capacity utilisation Energy efficiency of equipment Energy management Company's objectives Behaviour of people
Indirect Factors of Influence	Choices of technology Maintenance Organisational structure Investment possibilities and priorities

Direct Factors

- Capacity utilisation: Knowing the optimal capacity utilisation will result in the lowest specific energy use.
- Energy efficiency of the equipment: The characteristics of the equipment used will determine the usage of energy. If the equipment is more energy efficient, the lower amount of energy will be consumed.
- Energy management: Measuring, monitoring, planning and implementation of suitable programs, recording the progress, reports and feedback will improve the conservation of energy. Energy management is the strategic and systematic controlling of the usage of energy in order to result in lower energy costs
- Company's objectives: Besides the company's economic objectives to increase profitability by reducing production costs through reducing energy consumption, other goals of the company will also influence energy consumption. For example, to be part of the "green community" and be more "environmental conscious" due to the Corporate Social Responsibilities (CSR) today. Company's goal should be measurable and specific in order to be achievable.

- Behaviour towards energy conservation: The awareness towards energy conservation will influence energy consumption. Therefore, it is important to create awareness and educate staff on how to minimise energy usage without sacrificing the quality of the product and services. Human behaviour also includes guest awareness and willingness to participate in the energy conservation initiatives.

Indirect Factors

- Choices of technology: The technology of the equipment and gadgets can be energy exhaustive or energy saving.
- Maintenance: Proper maintenance is very much needed to ensure the energy efficient equipment and gadgets are working well and continue to serve for such purposes. Skilled workers especially engineers and technicians are important in this matter.
- Organisational structure: The organisational structure will influence the energy consumption due to the decision making (when purchasing equipment or gadgets), and responsible personnel / department to ensure the energy conservation plan is running smoothly and effectively.
- Investment possibilities and priorities: The decisions to invest on energy conserving measures are most of the time determined by the availability of capital and manpower.

External Factors of Influence

Similar to the internal factors of influence, the external factors of influence can also be divided into direct and indirect factors of influence on energy efficiency.

Table 1.2 *External Factors of Influence*	
Direct Factors of Influence	Energy prices, tariffs and supply Climatic conditions
Indirect Factors of Influence	Government policies The sector market

Direct Factors

- Energy prices, tariffs and supply: The capacity utilisation is influenced by the reliability of the energy supply which includes availability of energy supplied. The price of energy also plays an important role.
- Climatic conditions: Climatic conditions will influence the energy consumption especially temperature is the most important element. Apart from this, the humidity, rainfall should also be taken into consideration.

Indirect Factors

- Government policies: Government regulations and legislations will influence the behaviour of the hotel, in this case the behaviour of their energy consumption.
- The sector market: The demand for the hospitality product and the number of competitors (other hotels) will influence the level of energy consumption.

In Bohdanowicz and Martinac's (2007) research, the test of significance relationship was conducted by comparing energy consumption with the number of guest night as well as many other variables such as number of food covers served and in-house laundry load. Due to the smaller scale of this study, the researcher then scopes down the framework of the previous research by only identifying the relationship between the numbers of guest night with the individual type of energy being consumed which are water, gas and electricity. The justification for the modification of the conceptual framework by Bohdanowicz and Martinac (2007) is that all types of energy consumption including water, electricity and gas depend on a large extent of the number of guest night sold.

Significance of the Study

The findings of this research will benefit this four-star hotel in Kuala Lumpur by contributing a number of recommendations for its further improvement on energy conservation. As there are benefits of being an energy efficient hotel and pressures from the market and government, medium-sized hotels may be looking for the best practices samples from other hotels or literature for more knowledge and application of an effective and efficient energy conservation plan. The findings from this study can also serve as a blueprint or a reference to any medium-sized hotels that have the awareness of energy conservation and are interested to implement this environmental initiative plan. These establishments will have to investigate all factors that are included in the conceptual framework and then compare them with the existing literature in the process of developing a well-designed energy efficiency plan.

Literature Review

The Basic Steps in Planning an Energy Conservation Program

Flex Your Power Organization (2010) who published a guide for hotels on "Cutting Cost with Energy Efficiency & Conservation" stated that at the beginning, an energy audit needs to be conducted by the hotel to identify and forecast the current and future energy needs based on the records of current usage and options that are available for improvement. Subsequently, goals for energy conservation are set to be achieved based on analysis and forecasted results with an energy team appointed to constantly supervise, to observe the energy plan, as well as to develop specific ideas on conservation steps.

Benchmarking

As for the management to appraise the firms' potential for conserving energy, it is necessary to establish a baseline for energy performance. There are two key methods to form a baseline data (Flex Your Power, 2010):

- Create an accounting system to evaluate historical energy consumption. Any changes in the operating system, extreme external temperature or climate change and other factors that may influence the energy usage in a hotel should be taken into account.
- Use computer software to predict energy use in the hotel as it can assist the management to construct a model for energy consumption.

Energy efficiency and energy conservation measures are implemented to curb problems such as fluctuations in utilities expenses. With an energy accounting system, it will be able to predict and trace the energy performance of a hotel by comparing to the baseline

data and helping to identify problems that occur such as malfunctioning of cooling and heating equipment. Fedrizzi and Rogers (2002) explained that there are many factors that actually affect the energy consumption in the hotel industry and it is only reasonable to compare a hotel with the others that share similar characteristics.

Energy Efficiency of Equipment

Lightings

Fedrizzi and Rogers (2002) highlighted that lighting is the most energy consuming electric gadgets found in a hotel. Thus, most hotels use energy saving bulb in the guest rooms to reduce energy consumption. They further explained that to improve lighting efficiency, hotels not only need to invest in efficient lamps but also efficient fixtures. Mellgren (2009) also noted that switching from halogen lighting and incandescent bulb to florescent lighting is the fastest way to increase energy efficiency, whereby florescent lighting uses about one quarter of the energy of halogen lighting. There are also suggestions to use motion sensors to limit the number of unneeded lights to be left on in seldom-used rooms, public bathrooms and hallways (http://www.fypower.org).

Energy Management

Energy Management System (EMS)

Allen (2009) pointed out that Walt Disney World Resort uses the Energy Management System (EMS) to control the energy consumption particularly of the heating, ventilating and air conditioning (HVAC) equipment, and lightings. The EMS is installed in each building or facility of the Disney property. Such system assists Disney in managing the temperature and humidity set points and equipment operating time schedules. One of the most effective EMS used by Disney is the centralized server-based system that connects to the corporate Ethernet-based intranet of the firm.

Energy Information System (EIS)

Disney believes that in order to manage the energy utilisation, it is most important that the consumption must be measurable (Allen, 2009). Therefore, the duty of the Energy Information System (EIS) used in Disney is to measure the energy utilisation for energy management. This EIS functions in a way that it collects data from the EMS and channels them into actionable information for the use of operators and managers. The EIS will measure energy at facility level and track the level of energy conserved over time. Such utility reporting system will give feedback on a regular basis, inform the management on problems that need attention, and assist in reducing energy consumption without creating new problems.

General Conservation for Water

In hotels, large quantity of water is needed in order for the lodging operation to run smoothly in all aspects such as guestrooms, kitchens, laundry department, swimming pools and others. According to Deng and Burnett (2002), the annual water bills contribute significantly to the hotels' operating cost for medium-sized hotels in Hong Kong. Contrasting to the latter, Kumar *et al.* (1987, cited in Deng & Burnett, 2002) commented that the daily water consumption in the entire hotel is not directly related to the occupancy rate or total number of guest. Therefore, it is important to look into other variables that the management

can control in order to ensure that reduction in water usage is not only measured by the activities of guest alone.

General Conservation for Electricity

Palmer (1990) stressed that the basic rule of electricity conservation is to turn off the lights when they are not needed, but not sacrificing safety and security of the operation. Schneider *et al.* (1999) and Palmer (1990) both elaborated that cleaning functions should be if possible shift to daytime hours where the necessity to utilize electric lightings can be avoided. Light fixtures and lamps should be cleaned daily because dusty lamps and fixtures reduce the efficiency of the lighting system. Air conditioning should be re-set after the room is cleaned and only one light is to be left on during turndown service. Refrigerator in vacant room should also be disconnected from the main plug. Task lighting should be considered when designing to reduce use of overhead lighting, whereby it lights exactly where it is needed only (http://www.fypower.org). According to Chirarattananon *et al.* (2000), side-lighting which uses the principle by permitting the sunlight entering the side windows of the buildings and lightens up the area close to the windows, gives guests a fresher and natural feeling as compared to man-made lightings mentioned by Palmer (1990).

Company's Objectives

Allen (2009) also stated during a public service announcement of National Wildlife Week, Walt Disney defined "conservation" as:

> 'You've probably heard people talk about conservation. Well, conservation isn't just the business of a few people. It's a matter that concerns all of us. It's a science whose principles are written in the oldest code in the world, the laws of nature. The natural resources of our vast continent are not inexhaustible. But if we will use our riches wisely, if we will protect our wildlife and preserve our lakes and streams, these things will last us for generations to come'
>
> (Allen, 2009)

From this context, it demonstrates the attitude of Walt Disney's Environmental ethic where conservation has always been one of Disney's core values. And to uphold this core value, "Disney Energy Management Program" (EMP) is formed and there is a framework known as the "Disney's Environmentality Program" that demonstrates the effort of Disney in conserving its resources.

Behaviour of People

Staff Awareness and Motivation

The support from employees is also essential (Flex Your Power, 2010). Hence, they need to understand the importance of energy efficiency in the business and the significance of their action towards the firm as well as the environment.

Schneider *et al.* (1999) discussed that motivating staff to support an energy conservation program requires more planning than actual retraining. Hunt (1999, cited in Schneider *et al.,* 1999) from Holiday Inn Worldwide (HIW) mentioned that staff does not need

incentives to get involved in these programs, and in most cases, staff wants to participate in program that will benefit the environment. On the contrary, Schneider *et al.* (1999) argued that most staff needs motivation, whereby benefit can be given to staff such as passing small percentage of the saving to the staff. Traditional methods such as naming the most outstanding energy conserver of the month and providing recognition to staff that helps to achieve the result will bring positive impact to the energy management program (Brodsky, 2005).

Encouraging Guest Involvement

Schneider *et al.* (1999) also stated that in order to appeal to guest desire for energy conservation, room attendants must check the in-room literature on energy conservation programs and promotional material such as tent card, in-room door hanger or other materials to explain any program that requires guest participation. Guests would be required to take positive actions by demonstrating certain signs to indicate their choice. Goldstein et al. (2008) explained that the linen and towel reuse program in hotels is one of the oldest and most popular methods to conserve the energy which will have a direct influence on the electricity and water consumption levels of the hotel.

Indirect Factors of Influence - Choices of Technology

Sun-Lighting through Light Pipe

Chirarattananon *et al.* (2000) developed the idea of sun-lighting through light pipe which is suitable for multi-storied commercial buildings which are fully air-conditioned mainly in the Southeast Asia region, where the tropical climate is very similar throughout the year. According to Beltran, Lee and Selkowitz (1997), sun-lighting through light pipe is a technique where the light pipes will channel the light to the intended exit in the ceiling at the interior of the building. Beltran *et al.* (1997) further suggested that light pipes should be utilised at the side of the buildings that faces sun throughout the year.

High Efficiency Heating Equipment

Fedrizzi and Rogers (2002) discussed that condensing boilers that are highly efficient will help to reduce energy consumption. It is also suggested that instead of having a big boiler, it would be more energy saving when there are several installations of smaller boilers. Apart from this, the insulation on hot water and chill water piping need to be constantly repaired and also upgraded when it is necessary. The old pipes may have poor insulator during installation due to the technology back before. Thus, installing new piping with additional insulation will reduce the energy loss through the piping system. Variable speed drive can also be installed on the hot water pumping system to reduce the pumping energy during low periods of hot water consumption. Such technology is suitable for hot water pumps that operate on full time.

Solar Control Film

According to Chan *et al.* (2008), the solar control film is a polyester film where the thickness available is from 2-7mm. Several thin layers of films are attached together where it will absorb the solar heat and transmit it to the exterior glass, and the strong air current outside will cool the glass. Apart from functioning as a heat rejecter, the solar control panel will reflect radiant heat inside the building back to the outside space.

Coated Glass Windows

There are also other advance windows coating technologies available, such as the coated glass windows, where the products can effectively control the energy flow through the windows but it looks just like any other ordinary glass (Kaklauskas *et al.*, 2006). The advancement in the technology of the coated glass is very much suitable for hotels that are undergoing refurbishment whose objective is to improve the energy efficiency of the windows panes at the same time conserving the physical appearance of the original structure (Rosencrantz *et al.,* 2005).

Switchable Electrochromic (EC) Windows

International Energy Agency (IEA) had appraised a new technology developed in the laboratory known as the "Switchable EC windows" (Ruck *et al.,* 2000), where the light transmission level of the EC glasses can be adjusted from transparent to tinted by applying a small electric current, depending on the amount of incident daylight or the temperature (Chin *et al.,* 2008).

Electronic Key Cards

Erdogan and Baris (2007) found that the most of the hotels in Ankara, Turkey conserve energy by using the electronic key-card control system that will have thorough control over the electrical appliances in the room, whereby if the key card is not slot into the system there will be no power supply in the room.

Maintenance

Chan et al. (2009) indicated that improving maintenance activities will assist in conserving the energy consumption. It is also important to keep track on the age of the lighting fixtures. This is because old fixtures will consume more energy than the new ones. So, it will be more feasible to change the old and damaged fixtures to the new ones so that it will be energy efficient and will not spoil the bulb at the same time (Fedrizzi *et al*., 2002).

Organisational Structure

Persic and Jurdana (2006) reported that having an environmental management system alone is not enough, as it is important for the organization of the establishment to structure and plan activities, have someone to be responsible and be in-charge of the system, practices, have a clear written procedure, and resources to develop, implement, achieve, review and maintain the environmental policy. The main personnel who is/are responsible in taking charge of the implementation and evaluation should be clearly identified. Other than that, other departments or personnel who are also important for ensuring the plan to run smoothly should also work hand-in-hand with the key players (Persic & Jurdana, 2006).

Investment Possibilities and Priorities

The investment in energy efficient equipment is different from the investment on other assets which can generate revenue, which such equipment is non-revenue generating assets. Besides that, the fact where such equipment compared to the investment in other financial instruments such as stocks or bonds, this equipment is less liquid because it is not always but most of the time difficult to be resold, and depreciates over time. This lack of

resale potential contributes to the risk in investing on such energy efficient equipment (Golove & Eto, 1996).

External Factors of Influence - Direct Factors of Influence

Energy Prices and Tariff

Chan *et al.* (2009) suggested that identifying the power factor of the equipment and machines in the hotel can reduce the maximum demand charge due to the lower apparent power in kilovolt-amperes. Therefore, the hotel management should identify the electricity tariff that is suitable for the demand of the hotel. Identifying the peak and off-peak electricity tariffs will also assist in energy management.

Climatic Conditions

According to Bohdanowicz and Martinac (2005), due to the climatic condition of a certain destination, it is reasonable to assume that hotter destinations will lead to the consumption of energy for space conditioning and this significantly affects the total electricity consumption.

Indirect Factors of Influence

Government Policies

There are some countries that implemented a compulsory requirement on energy conservation for buildings (Janda & Busch, 1994). For example in the Philippines, Singapore and Thailand, their government requires the commercial buildings to have overall thermal transfer value (OTTV) that does not go beyond a constitutional limit set by the government (Verdote, 1994). Chirarattananon and Taveekun (2004) reported that in Thailand, the management of every large commercial building needs to carry out energy audit and formulate plans to improve on energy efficiency, as written in the Energy Conservation Promotion Act (ECP Act) in 1992.

The Sector Market

Granzin and Olsen (1991) proved that consumers nowadays are more knowledgeable about their surroundings, especially the environmental problems. These people who are more educated are willing to pay more for a greener product. Newell and Green (1997) also found that income and educational level are important factors that will lead to their demand of environmental friendly products because they will have the ability to make such decision when they have higher disposal income.

Research Methodology

Research Strategies

In this research, the case study strategy will be used as it is beneficial especially for researcher who wishes to gain an in-depth understanding pertaining to the factors that will influence the energy efficiency. The primary data will be collected from interviews and secondary data from documented data (i.e. from the Environmental Policy of a four-star hotel in Kuala Lumpur). In this research, the semi-structured interviews will be conducted. The interviews will be held individually due to the different nature of questions that will be asked. The policy will triangulate findings together with the primary data that is collected through interviews.

Statistical Treatment

The parametric statistics will be used to treat the quantifiable data, in this case the gas, water and electricity consumption and also the guest night of the four-star hotel in Kuala Lumpur. The simple linear regression analysis will be adopted by the researcher to identify the strength of a relationship between one independent variable and another one dependent variable. The regression analysis will be using a 3-year database from year 2006-2008. The general simple linear regression is:

$$Y = a + bX + \varepsilon_i$$

In this case, the independent variable (X) is the number of guest night, and dependent variables ($Y_{1, 2, 3}$) are the consumption of electricity, water or gas. ε_i is the random error.

The historical data of the variables will be entered into the Microsoft Excel and the statistical test (Regression) can be conducted by using the same software. The result will demonstrate the p-value, which is the probability value of the test result. It will determine statistically if there is any significant relationship between the two variables.

To test the statistics the null and alternative hypotheses must first be stated as the following:

H_0 : There is no significant relationship between the number of guest night and amount of energy (electricity, water, gas) consumption.

H_1 : There is a significant relationship between the number of guest night and amount of energy (electricity, water, gas) consumption.

The significance level of 0.05 or also known as 95% confidence level is used throughout this research, whereby if the p-value is smaller than or equal to 0.05, H_0 is rejected and if the p-value is larger than 0.05, H_0 is accepted.

Results and Discussion

Profile of Respondents

This chapter will present the primary data obtained which via the interviews and also secondary data obtained from the four-star hotel in Kuala Lumpur. The following is a table listing the profile of each respondent that was being interviewed throughout the period of study.

Table 4.1
Profile of Respondents and Interview Date

Designation	Position in Green Globe Team	Interview Date (dd/mm/yy)
Resident Manager	Committee Member	07/09/10
Food & Beverage Manager	Committee Member	07/09/10
Human Resource Director	Committee Member	07/09/10
Financial Controller	Committee Member	07/09/10
Chief Security Officer	Chairman Culture of Saving	21/09/10
Executive Chef	Committee Member	21/09/10
Chief Engineer	Chairman Green Globe 21	05/10/10
Executive Housekeeper	Committee Member	12/10/10
Front Office Manager	-	12/10/10
IT Manager	-	12/10/10

Analysis of Factors that Influence Energy Efficiency

Electricity Management

From the findings, the electricity usage can be managed efficiently by having a good housekeeping system. A good housekeeping system involves the allocation of tasks during the day time to avoid the usage of man-made lightings, cleaning the windows often to maximise natural lightings penetration, as well as cleaning the light fixtures often in the hotel. Such practices may seem to be insignificant. However as explained by Palmer (1990), even basic rules similar to this will have an impact in reducing electricity consumption. Apart from this, this four-star hotel also employs the principle of side-lighting which is strongly recommended by Chirarattananon *et al.* (2000) that windows which do not have any curtains and lights near to them do not need to be opened, unless there is a necessary when the day is gloomy outdoor.

Water Management (Water Conservation)

The four-star hotel manages its water consumption by measuring and monitoring the water usage on a daily, monthly and yearly basis to keep track on its utilisation. The reading of the water consumption is then measured against the guest occupancy, as this is the easiest way to identify if there is any defect of energy water related devices by observing on any unusual fluctuation. All staff members are well-trained and reminded constantly pertaining to water management, from simple tasks like turning off the tap tightly after use to something more complex such as rectifying the water pipe system. Housekeeping staff are well-trained that they should always report to the maintenance department if any water saving or related devices are malfunctioned especially in guest rooms and public areas. By resolving these problems, the wastage of significant amount of water will be prevented. These action plans are clearly stated in this four-star hotel's Environmental Policy and are the responsibilities for the staff to comply. These actions may not be gigantic enough to cause significant control over water consumption level in the hotel. However, a study was conducted by Deng and Burnett (2002) where these similar best practices were implemented by other hotels in Hong Kong, and said to be successful in managing the water consumption.

However, Deng and Burnett (2002) also suggested that establishments may also collect rain water for purposes such as watering the gardens, plants, car wash and others. This may be appropriate for most places in Malaysia to develop the rainwater collector system to conserve water as it is a tropical country which receives rain throughout the year.

Company's Objectives

The results show that the mindset of the management team towards the environment greatly influences the decision and the action of an establishment in conserving the energy consumption. There is a similarity between what this four-star hotel and Walt Disney have done. Despite the business objective is to have more profit by having lower operational cost, it is part of their values that doing business in an environmental conscious way is equally important. For an organization to be conscious in this way, core values, vision and mission need to be clearly set, understood by all staff, and be uphold. The Environmental Policy clearly demonstrates the effort of this hotel in saving energy. This is similar to what Walt Disney has been doing by having its own "Disney's Environmentality Program" (Allen, 2009).

Behaviour of People

The finding also reveals that this four-star hotel is aware of the importance of the management team to create awareness among the staff, provide training and at the end of the day motivate them by passing them the monetary savings that the internal community manages to collect. Even though it is arguable that the savings collected is through the 3R (reuse, reduce and recycle) program. However, this hotel has all these (3R and energy conservation) highlights under its Environmental Policy as a whole which will most of the time but not always directly influence the decision of the staff to be willing to reduce the energy consumption. The idea of motivating the staff to support the energy conservation program is supported by Schneider *et al.* (1999) that most staff needs motivation where benefit can be given to staff by passing small percentage of the savings. In a contrasting statement, Hunt (1999, cited in Schneider *et al.,* 1999) disagreed and stated that staff will be willing to get themselves involved even without any incentives due to the genuine intention towards the goodwill of the environment.

Besides the internal staff, the four-star hotel also pays attention to the contribution that guests may have towards reducing the energy consumption level. The method that it employs may seem to be typical but the response from guests is quite overwhelming according to the Housekeeping Executive. The action that guest can demonstrate is to follow the instruction on the small card hanging on the door knob that explains the energy conservation program. This can encourage the participation of guests in the energy saving effort. The feasibility of such attempt is well supported by Goldstein *et al.* (2008) that even though this method is one of the oldest to conserve energy, it is proven to be a direct influence on the energy consumption level.

Electronic Key Cards and Energy Saving Key Card Switch

Being a modern hotel, this four-star hotel in Kuala Lumpur utilizes the technology of the electronic key card system by incorporating with the energy saving key card switch (slot) into the guest room to control over the electrical appliances in the room. According to the Housekeeping Executive, even though there are tendencies of guests who will replace the key card with their personal cards while they are away from their room, the percentage of guests doing such action is relatively small. Hence from this hotel's point of view, such technology is still said to be efficient. The effectiveness of the system is also proven by Erdogan and Baris (2007) when they found out that most hotels in Ankara, Turkey are also employing the electronic key-card control system to conserve energy consumption in the guest room.

Heating Equipment and Fixtures

It is found that the heating equipment highly consumes electricity in a lodging establishment. By identifying the energy consumption and its efficiency, as well as understanding the technology, the management team will be able to control the energy consumed. If the consumption level is high, it is advisable to look into the real reason behind, whether it is due to the technology of the heating machine itself or other supporting fixtures such as the hot water pipe. In this four-star hotel, the old heating machine is replaced with a new dual-system heating machine which also produces free cold air for air conditioning purpose. This hotel is aware that it is important to purchase a highly efficient equipment to help save energy, similar to what is mentioned by Fedrizzi and Rogers (2002).

As for the hot water pipe, this four-star hotel also changes from the copper pipe which is less energy efficient to the new PRV pipe that comes with the insulator. This method is justified to be an effective action as Fedrizzi and Rogers (2002) also stated that more energy will be conserved when the water is channel through piping system with insulators, when heat is not loss to the surrounding.

Maintenance

Maintenance work is important and need to be done periodically. The frequency for maintenance should depend on the nature of the equipment or devices. This importance is justified when both the Chief Engineer of this hotel and also the academician Chan et al. (2009) said that maintenance activities will help to reduce energy consumption. Ensuring the performance of the equipment to its best condition will help to save energy, as faulty equipment has the tendencies to consume more energy than it should.

Organizational Structure

From the findings, it is identified that besides having a key player to hold the major responsibilities concerning to the implementation of the Environmental Policy and related issues, a Board of Committee is formed. In this case, instead of having only one person to keep an eye on the effectiveness of the policy, there is a whole team consists of nine Departmental Heads and the General Manager in this four-star hotel in Kuala Lumpur. Each and every committee has their respective roles to play in the individual departments, to share the burden of the Chief Engineer who is the main personnel responsible for all energy conservation issues. Similar to Persic and Jurdana's (2006) discussion, this hotel does encourage its committee members to be innovative to provide recommendations for further improvement. Such strategy is good for a hotel establishment because in a lodging industry, job descriptions for every department are very different from one another. The Chief Engineer may not have the expertise to solve problems or find a better solution for others. Thus, by having a committee board, it highlights that there is a need for the whole team to keep an eye for one another, and to work as a team, because without a team's corporation, the Environmental Policy will not work in a long run. Having a separate team specifically to emphasise on their concern towards the energy consumption, is one of the company's core values, where this hotel will have a closer look and specific control over certain issues that arises pertaining to the environment.

Investment Possibilities and Priorities

From the literature, it is stated that there are sometimes barriers for an establishment to invest in equipment and fixtures that are energy saving. This is probably due to the different company's value which sets different priorities when they have a certain budget to spend on investment. In this four-star hotel, the reason that they place a high priority of purchasing energy saving equipment is because of their strong core values and also their long term strategy to gradually change all their equipment to new ones that are highly efficient and save energy.

Tariffs

The establishment has two types of heating machines – one old, another new. The old one is less energy efficient where it consumes more electricity as compared to the new one.

It is a very wise decision to operate both machines at different periods of the day, by taking into consideration of the tariffs for peak and non-peak hours. This is similar to the suggestion by Chan *et al.* (2009) that by knowing the tariffs for different period of the day, it will assist in saving energy. This is not only applicable for electricity, in fact it is appropriate for other forms of energy as well. Establishment should consider this as an advantage as other strategies may also be developed by utilizing off-peak period to perform certain high voltage activities if possible.

Quantitative Analysis – Relationship between Guest Night & Energy Consumption

The following is the table tabulating the results of simple linear regression analysis and also the decision to reject or accept the null hypotheses (H_0).

Table 4.11
Result of Simple Linear Regression Analysis and the decision to reject or accept the Null Hypothesis

		p-value	Decision	Significant Relationship between *X* and *Y*
Guest Night (*X*)	Electricity (Y_1)	0.0194	Reject	Yes
Guest Night (*X*)	Water (Y_2)	0.0015	Reject	Yes
Guest Night (*X*)	Gas (Y_3)	0.1267	Accept	No

From the summary output generated by Microsoft Excel, it is shown that the R-square for guest night against electricity consumption is 0.1504 indicating that 15.04% of the changes in electricity consumption are explained by the changes in guest night. The remaining 84.96% of the changes are not explained by guest night, but other independent variables. The slope of the simple linear regression is 2.122 indicating that every one unit of increase in guest night, electricity consumption will increase by 2.122kWh.

For water consumption against guest night, the R-square is 0.2586, showing that 25.86% of the changes in water consumption are explained by the changes in guest night. The remaining 74.14% of the changes are not explained by guest night, but other independent variables. The slope of the simple linear regression is 0.214 indicating that every one unit of increase in guest night, the water consumption will increase by 0.214m^3.

The evidence shows that there is no significant relationship between guest night and gas consumption in this four-star hotel in Kuala Lumpur. The R-square of these two variables is 0.0672, indicates that only 6.72% of the changes in gas consumption are explained by the changes in guest night and the remaining 93.28% are explained by other factors. The slope of the simple linear regression is -0.0666, indicating a negative relationship between guest night and gas consumption. This explains that every one unit increase in guest night, the gas consumption will decrease by 0.0666kg.

The other variables that may be able to explain the changes of electricity, water and gas consumption besides the guest night are not in this modal of research. These variables may be due to numbers of functions, including meetings and seminars held in the establishment using the function room which needs electricity to ensure the facilities such as

air condition and lightings to work. Apart from that, it may also due to number of external guests who do not stay overnight but involve in other activities in this hotel, such as dining in different restaurants available for breakfast, lunch and/or dinner. Even though these guests do not overnight in the premise and register as hotel guests, it is inevitable that their presence and activities will influence the energy consumption in the hotel. It is cited in Kumar *et al.* (1987, cited in Deng & Burnett, 2002) that the daily energy consumption in the entire hotel is not directly related to the occupancy rate or total number of guest. Therefore, it is important to look into other variables that the management could control in order to ensure that reduction in water usage is not only measured by the activities of overnight guest alone.

In this hotel, the measuring and monitoring of energy consumption is currently performed by a simple calculation of certain energy consumption against the guest night. Such measuring tool may be improvised by identifying other measurable variables so that this hotel has a better stand in controlling the energy consumption, with more specific areas of improvement. Specifically for gas consumption in this hotel, it is hypothetically tested that there is no significant relationship between the gas consumption and the guest night. This indicates that the guest night is not an appropriate variable to measure the changes in gas consumption in this particular hotel.

> The negative relationship between the gas consumption and the guest night can be explained by the economies of scale. Sloman (2003) defined economies of scale as: "When increasing the scale of production leads to a lower cost per unit of output"
> (Sloman, 2003)

In this model, there is no monetary unit (cost) that is incurred, but it is justifiable that the gas consumption will eventually lead to the "cost". Thus, taking this economics principle to explain the negative relationship between the two variables is appropriate. In this case, by applying this microeconomics principle to the context of the gas consumption, it simply refers to the advantage the Food and Beverage Department will obtain in the gas consumption when there is an expansion in business (increase in guest night). This long-run concept explains that the reduction in the gas consumption (kg) per guest night as the size of the guest night increases. The economies of scale occur due to the greater efficiency of large equipment (Sloman, 2003). This is explained when large equipment in the conventional kitchen may be more efficient in the sense that more output (end food product) can be obtained for a given amount of input (gas). For example, the conventional oven is used to bake muffin for buffet breakfast will be more efficient when it is fully utilised to its maximum capacity, where the amount of gas needed will be the same regardless of the number of muffins being baked at a time.

Conclusions and Recommendations

Conclusions

In order to obtain energy efficiency, hotels should have a clear objective which is shared by the whole management and their operational staff. The company goal should also be measurable and specific in order to be achievable. By leaving in-room cards or door hangers that explain about the program and certain actions for guests to demonstrate, they are encouraged to express their willingness to be part of the energy saving effort. It is also

important for hotels to look into the choices of technology that will be engaged in the building. In addition to this, hotels should be aware of any government policies pertaining to the energy saving effort, especially if there is any benefit that can be obtained by complying with the government's effort in promoting energy conservation.

From the hypothesis testing, it is found that there is a significant relationship between the electricity consumption and the number of guest night, as well as between the water consumption and the number of guest night. However, the results show that there is no significant relationship between the gas consumption and the number of guest night for this four-star hotel in Kuala Lumpur.

Recommendations

The researcher believes that this four-star hotel should look into the government policies with regards to their energy conservation initiatives. This is because according to the Chief Engineer of this hotel, government policies is not a factor that determines the energy efficiency plan for this establishment. In fact, by looking into the policy and government initiatives, there are benefits that this hotel could gain and they will assist the establishment to continue to improve in its energy conserving efforts. The management could also be more specific pertaining to the annual budget that they would want to allocate in the investment of energy saving gadgets or equipment, instead of having the current budget parked under other budgets of the respective departments.

Future Research

There are several limitations in this research, where the researcher believes that they may benefit in the future research. In the case of determining the relationship between the number of guest night and the energy consumption, it is later found out that the daily energy consumption in the entire hotel is not directly related to the occupancy rate or the total number of guest which is cited in Kumar *et al.* (1987, cited in Deng & Burnett, 2002). Hence, in the future research, it is important to look into other variables that will directly affect the energy consumption. Future researchers are also recommended to look into those factors that are being studied in a more in-depth or width manner as certain factors are too wide to be entirely covered in this research. For example, the "choice of technology" is a factor that has substantial literature and the advancement of technology today causes this area of study to be more complicated.

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