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Development of energy saving conservation for educational institution

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ABSTRACT

Nowadays, electricity is the most important source of energy for each home or workplace. Consequently, an action should be planned and taken to take advantage of the benefit by using electrical energy prudently. To achieve this, the use of energy-saving equipment become crucial as they will also reserve the cost as well as providing comfort to our daily lives. This study focuses on electric energy conservation with the use of energy efficient tools (ESD), LED in the office building. The aim of this study is to identify the effects of LED lighting in the building which is available using the fluorescent light from the type of T8 36w lamps. The design of experiments using two types of headlights are T8 36W and two types of Light Emitting Diode (LED) lamps as samples. Current Data (I), Voltage (V) and Power (W) are recorded to evaluate the power difference used by both lamps. Random lighting measurements near lights are recorded using Digital Lux meters. The findings from this study showed that the use of LED lamps was more economical in terms of cost, power consumption and better lighting to its environment. It is also recommended to take the initiative to convert the existing T8 36W to LED lamps at all locations in the campus buildings to reduce the power of the electric energy (kWh) therefore the energy will be conserved as well as saving the cost of electricity usage.

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Introduction

The use of electricity in commercial buildings requires serious attention because electricity is the main source of energy currently used compared to other needs.(Ahmad et al., 2012) Generating resources such as oil, coal and others will increase the cost if the material starts to decrease. Thus, as well as the use of electrical energy prudently and save, the savings that can be done need to be figured out directly so that the benefits of this energy savings can be retained. Nowadays, it is undeniable that lighting is a major need in every building, housing, road or office or any other place. Should be for better energy saving, saving factor should be the main element first before the construction of a building to be carried out thus avoiding additional costs, but for existing building buildings, the ability for energy saving is limited. For this, a savings plan needs to be thought of from aspects that can have a solid impact. In Malaysia, a significant waste of electricity in the Malaysian community can be contained in the event that consumers are more able to appreciate electricity and see that

there is a way for them to make savings if they do not want to incur high billing costs and to accept the fact that electricity subsidies are not a permanent burden of the government.(Grace Shofie Gerijih & Patricia Serai Phillip, 2013)

Malaysia Energy Sector

Malaysia faces many challenges in the era of globalization on its quest to achieve developed nation status. For more than 20 years, Malaysia has successfully diversified its energy consumption by taking advantage of domestic energy resources such as oil and natural gas. In particular, the increase in population will lead to an increase in terms of electricity consumption in Malaysia as mentioned in (Mohd Zuhair Azuar, 2015). The following are statistics on Installed Generation Capacity (MW) and Final Energy Demand by sector from 2015 to 2018 in Malaysia. We can see the Installed Generation Capacity in Malaysia rising from year to year, and so does the final energy demand that affects the rise in the sector residential and commercial. Based on the increase in this data, the increase in energy needs will continue to occur with the development of technology and a savings in energy consumption needs to be planned so that we have no problems with rising costs.

Energy Conservation

Energy conservation refers to the effort made to reduce energy consumption in order to preserve resources for the future and reduce environmental pollution. It can be achieved through efficient energy use (when energy use is decreased while achieving a similar outcome) or by reduced consumption of energy services.

Table 1 <Final Energy Demand By Sectors (kloe) Malaysia Energy Information Hub>

Year	Final Energy Demand by Sector (kloe)				
	Industrial	Transport	Agriculture	Non Energy	Residential and Commercial
2015	13989	23435	895	5928	7559
2016	16019	24004	415	8729	8051
2017	17463	24039	673	12517	7796
2018	19046	23555	1021	13262	7774

Literature review

Switching from ordinary light bulbs to led lights is an effective way for us to help reduce energy wastage in our homes and prevent greenhouse gas emissions that could cause global climate change(Mollah et al., 2012). Consequently, with inexpensive installation costs and the use of Solid fluorescent lights are increasing from day to day in our country but is very regrettable because this compact fluorescent light provides an insignificant savings until the life period ends. Pencahayaannya quality is also lower even if it is still in the efficiency of lighting allowed by a commissioned body. There are various methods that can be practiced in responding to the government's recommendations in providing more effective energy savings in government buildings. However, it should be remembered that every method that is to be used should have a careful and meticulous planning in order to provide the best savings rate as well as able to maintain the comfort level of its employees.(Nezuan & Aishah, 2017)

In another study, LEDs have the advantage of influence on the quality of lighting in addition to the use of electric currents that are smaller than ordinary T8 fluorescent lamps. (Suharijanto et al., 2015). LED has smaller current comparing T8 fluorescent lamps using ballast rated at an average of 36W. On average, the power consumption rate of a 36W T8 fluorescent lamp can be calculated using the following formula:

PTUBE= ($P_{\text{fluorescent tube}} + P_{\text{ballast}}$) x power factor

TOTAL POWER USED FOR SINGLE T8 LAMP = (36W +36W) x 0.88 = 63.43Watt.

Method

This section described the flow and method of testing that is carried out, which is to obtain the actual data of current, voltage and power consumption of the lamp lamps tested. This research will be more robust if we plan the lamps to be tested to choose the type of lamp that has more impact in terms of energy saving.(Dhingra & Singh, 2009). Therefore, with good planning, it can provide a more extensive comparison of experimental

data. This study adopts an element of electric energy saving which is a very good thing for the survival of future generations. Therefore, after this study, the effort to enhance the awareness of electricity in the institutions especially the students should be upgraded because this group is a most and most active user.(Hussain et al., 2013).

In this study, 4 types of lamps were tested, namely from the types of fluorescent lamps T8 36W 1.2m, T8 18W 0.6m, T8 1.2m LED 30W and T8 0.6M LED 10W. All these lights are connected to a 240V AC power supply to get current and voltage readings. To get a more accurate value, 2 units of T8 1.2m 36W and 2 units of LED 1.2m 30W were tested together with two other 2 unit of T8 lamps 0.6m fluorescent and LEDs rated 18W and 10w respectively. This light is on and left on for 1 hour to see if there is a change in current during operation. The current and voltage for each lamp are recorded every 30 minutes using the Digital Ampere Clamp Meter. Then these lights are turned on again separately to take the average reading for illumination using Digital Flux Meter. (Illuminance Flux Meter).

As a result of this experimental data, the total power consumption for each type of lamp is calculated in kilowatt form and the total energy consumption for a period of 1 month (kWh/ m) can also be obtained. The total electricity consumption to be paid is calculated by the following method: Total energy consumption =(kWh / m) x RM 0.430 and this payment refers to Tariff B of commercial building RM 0.430 for all kWh used.

Table 2 <Load Statistic In Campus>

Type of lamp	Total T8 lamp in the campus	Watt/unit
T8 1.2m	6348	36w
T8 0.6m	357	18w

Result and Discussion

Below are the readings of the experiments that have been conducted:

Table 3 <Result>

Experiment type	T8 36W lamp1	T8 36W lamp2	LED 30W lamp1	LED 30W lamp2	T8 18W lamp 1	T8 18W lamp2	T8 10 W LED1	T8 10 W LED2
Current (A)	0.335	0.332	0.18	0.18	0.28	0.28	0.062	0.062
Average current(A)	0.33		0.18		0.28		0.062	
Power(W)	70.75	70.75	43.2	43.2	59.13	59.13	14.88	14.88
Average Power(W)	70.75		43.2		59.13		14.88	
Lux 1	340	406	635	718	319	321	391	401
Lux 2	353	414	689	682	311	315	401	412
Lux 3	370	442	725	662	323	319	364	428
Average Lux	354	420	683	687	317	318	385	414

Table 4 <Saving>

Type of lamp	Power Consumption (kW)	Total energy Consumption (kWh/m)	Bil payment	MYR
T8 36W	402.20kW	80,440kWh/m	80,440kWh/m x 0.430	RM34,589.2
LED 30W	274.23kW	54,846 kWh/m	54,846kWh/m x 0.430	RM23,583.7
T8 18W	11.3kW	2,260kWh/m	2,260kWh/m x 0.430	RM971.8
LED 10W	5.31kW	1,062kWh/m	1,062kWh/m x 0.430	RM456.6
SAVING T8 36W to LED 30W	RM 11,005.5		SAVING T8 18W to LED10W	RM 515.2

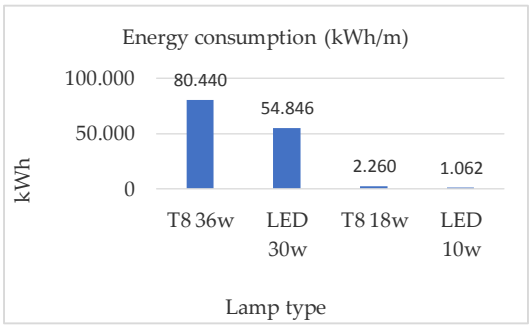

Figure 1 <Total Energy Consumption>

From the graph of total energy savings (kWh), it can be shown that the use of 30W LED lights is more economical which is 54,840 kWh/ m compared to fluorescent T8 36w 80,440kwh/m which is a saving of 25,600 kWh / m with an estimated cost savings of RM11,008.0 per month. For 10W LED lights, energy consumption of 1,062kWh/m compared to T8 18W which is 2,260 kWh/m with energy savings of 1,198kWh / m and total cost savings of RM 5152.2. All electricity consumption charges are calculated in Malaysian currency. (MYR)

Conclusions

The cost of electric energy payment if not controlled will affect an organization. Nowadays, almost all of our work premises need a source of lighting for the comfort of work. Anywhere lighting systems are used everywhere from houses to offices, industries, shopping malls and highways. The cost of electricity is increasing This is the reason people are looking for energy saving lamps.(Islam et al., 2015) Energy saving lighting system like (CFLs) compact fluorescent light, (LEDs) light emitting diode and smart sensor are the promising key factor at achieving at sustainable environment in the aspect of energy efficiency and quality lighting(Sorcar, 1982). Using energy efficient tools will provide us with electricity savings as well as financial expenses.. Replacement of energy efficient lamps such as LEDs is easier compared to other electrical appliances such as air conditioners, electric heaters, cooking units and other high-rated electrical appliances. It involves the cost of purchase, installation and maintenance costs of the device itself.

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