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COMPARATIVE STUDY OF RESIDENTIAL LIGHTING IN GURUN, KEDAH

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ABSTRACT

***Abstract**: This study focuses on comparing LED lighting and fluorescent lighting in terms of illumination quality and cost-effectiveness in residential buildings in Kedah, Malaysia. The objective is to provide homeowners with valuable insights to make informed decisions regarding lighting technology selection, considering factors such as initial cost, energy efficiency, and lighting quality. The research adopts a case study approach, collecting and analyzing data on illuminance levels, costs, and lifespan of both lighting types. The findings reveal that LED lighting outperforms fluorescent lighting in multiple aspects. LED lighting exhibits superior power quality, offering greater energy efficiency and lower power consumption. It provides enhanced illumination quality, including brightness, color rendering, and lighting control, leading to a more comfortable and visually appealing environment. Furthermore, LED lighting proves to be cost-effective in the long run due to its longer lifespan and energy-saving capabilities. Therefore, it is recommended that homeowners in Kedah prioritize the installation of LED lighting for their residential buildings, benefiting from improved lighting quality, energy savings, reduced environmental impact, and long-term financial advantages. By embracing LED lighting, homeowners can contribute to sustainability, enhance the overall lighting experience, and make cost-effective choices for their homes.*

Keywords: Artificial Lighting, LED Lighting, Fluoerescent Lighting

INTRODUCTION

The study explores the significance of lighting in residential structures and compares two major lighting technologies: fluorescent lighting and LED lighting. It emphasises the many features and performance of lighting technologies, such as fluorescent lighting's low energy consumption and long lifespan, and LED lighting's energy efficiency and long lifespan. The study's goal is to assess the lighting quality and cost-effectiveness of various technologies in Malaysian houses. The study has three goals: to identify the types of lighting technologies utilised in residential structures, to analyse their performance in terms of lighting quality and economy, and to determine which lighting technologies give the greatest value. By addressing these goals, the research hopes to assist homeowners in making educated decisions regarding the best lighting technology for their homes.

The study compared LED lights to fluorescent lighting with equal brightness, colour, and voltage characteristics. The study took into account elements such as original cost, operating cost, life duration, and illumination quality. The study is confined to comparing these two lighting systems and is being done at the researcher's home over a one-year period. The findings of the study are intended to be useful in assisting homeowners in selecting the most effective lighting technology for their residential structures, therefore contributing to Malaysia's energy-saving goals.

LITERATURE REVIEW

Light is a kind of electromagnetic radiation that can be seen with the naked eye. It falls within a certain wavelength range, often between 380 and 780 nanometers, according to The Lighting Handbook (2019). These wavelengths allow us to comprehend our surroundings, with varying wavelength levels correlating to different times of the day. Our cones are active during the day, letting us to see colours, but at night, our rods take over and we detect shades of grey.

Light is widely used and provides a variety of functions for people. According to The Lighting Handbook (2019), one key application is for visual purposes. Light is used to illuminate job areas in line with applicable standards, ensuring sufficient visibility while avoiding glare and discomfort. This emphasises the importance of lighting design in providing a well-lit and functional environment for a variety of activities.

Artificial lighting

Artificial lighting is important in buildings because it provides illumination when natural light is inadequate. LED lighting has evolved as an energy-efficient option, lowering energy consumption and CO2 emissions (International Energy Agency, 2019). Energy savings and occupant comfort are ensured by proper lighting design, which includes the use of lighting controls. To maximise the performance and efficiency of artificial lighting systems, maintenance is required (Guerin et al., 2016).

However, there are several disadvantages to using artificial illumination. Energy use continues to be a source of worry, contributing to climate change (International Energy Agency, 2019). Heat production and related health consequences, such as altered sleep patterns, should be taken into account (Guerin et al., 2016). Adopting energy-efficient lighting solutions and addressing health consequences are critical for maximising the advantages and mitigating the negatives. In short, artificial lighting offers benefits such as increased visibility and adaptability. LED lighting provides energy savings, but it also has environmental and health implications. For artificial lighting systems to be sustainable and successful, proper lighting design, maintenance, and consideration of environmental and health considerations are required.

LED lighting

LED lighting has emerged as the most energy-efficient alternative for commercial buildings. These bulbs, which use semiconductors to create light, outlast incandescent and fluorescent lamps. Furthermore, LED bulbs have the unique capacity to be customised for colour and intensity, allowing for greater versatility in lighting design. According to research published in the journal Energy and Buildings, moving from incandescent bulbs to LED lamps can result in significant energy savings of up to 85% (Lee et al., 2016). This highlights the tremendous environmental and financial benefits of using LED lighting technology.

Fluorescent lighting

Fluorescent lighting save energy and have a longer lifespan. An electric current is sent through a gas-filled tube, creating ultraviolet light that is transformed into visible light by a phosphorescent coating. When compared to incandescent lights, fluorescent lamps can cut energy consumption in buildings by up to 50%, according to a study published in the journal Building and Environment (Boubekri et al., 2013). This study emphasises fluorescent lighting technology's great energy-saving potential, making it a viable option for promoting sustainability and lowering power costs in a variety of contexts.

METHODOLOGY

The research methodology is to gather data on lighting technologies in residential buildings, with a primary focus on LED and fluorescent lights. The researcher intends to assess the illumination quality as well as the cost-effectiveness of different systems. The case study takes place in the researcher's personal residence at No. 464, Taman Seri Utama, 08300 Gurun, Kedah, Malaysia. Data collection included gathering starting cost and lifetime information from lighting manufacturers, as well as taking illuminance readings with a lux metre. The collected data is analysed and compared, and each lighting technology provides a rating value. The research design and strategy, as well as the processes for data collecting and analysis, will support the research objectives and contribute to the study's results.

DATA ANALYSIS AND RESULTS

The analysis of data results will be the major emphasis of this chapter. Two sets of data will be presented: one from the lamp manufacturer, namely Philips' official website and online catalogue, and the other from testing findings. The data contains information on two lighting systems, LED light and fluorescent light, with the lux metre readings being the parameter of interest. The next step is to perform a comparison research to evaluate the differences in data from each lighting system.

Data from manufacturer

Because of its official source, the data collected from the manufacturer, Philips, is regarded credible and accurate. The information will be provided in tabular form, allowing for thorough study. A thorough grasp of the variations in lux metre readings between LED light and fluorescent light may be achieved by analysing both the manufacturer's data and the testing results.

Table 1: Data from Lighting Manufacturer of LED Light and Fluorescent Light

Parameter / Lighting Type	LED Light	Fluorescent Light
Initial cost (RM)	17.90	6.40
Power consumption (Watt)	8	18
Voltage (V)	220-240	230
Frequency (Hz)	50-60	50
Luminous flux/Lumen (Lm)	1350	1050
Nominal lifespan (Hour)	15,000	13,000
Energy saving (%)	80	30

Testing results

The data was then collected at a local location in Taman Seri Utama, Gurun, Kedah, which includes various rooms such as living areas, bedrooms, a kitchen, a washbasin area, a dining area and a bathroom. A lux metre device was utilised for testing to acquire illuminance data.

Table 2: Lux Meter Testing Results

No.	Area	Lux Reading (Lux)	
		LED Light	Fluorescent Light
1.	Living area 1	134	121
2.	Living area 2	149	125
3.	Dining area	121	105
4.	Kitchen area	151	149
5.	Sinks area	142	139
6.	Toilet	250	221
7.	Bedroom 1	122	76
8.	Bedroom 2	160	153
9.	Bedroom 3	253	175
10.	Bedroom 4	70	61

Calculation cost

To compare the prices of LED lighting versus fluorescent lighting, a comparative study was performed. Several aspects were examined in the research, including initial bulb cost, kilowatt hour use, TNB price, and monthly operations expenditures. The goal was to calculate the monthly running expenses of each form of illumination. To offer a full perspective of the cost estimation, these parameters were reviewed in a table style.

Table 3: Cost Calculation for LED Lighting and Fluorescent Lighting

Lighting Type	LED Light
LED lighting	**Initial cost of one light = RM17.90** Kilowatt hour (24h) = 0.19 kWh TNB tariff = RM0.218/kWh Assume eight hour per day use, in 30 day equal to 240 hours: Kilowatt-hour use = 0.19 x 10 = 1.9 kWh Running cost per month = 1.9 kWh x 0.218 **= RM0.41**
Fluorescent lighting	**Initial cost of one light = RM6.40** Kilowatt hour (24h) = 0.43 kWh TNB tariff = RM0.218/kWh Assume eight hour per day use, in 30 day equal to 240 hours: Kilowatt-hour use = 0.43 x 10 = 4.3 kWh

	Running cost per month = 4.3 kWh x 0.218 **= RM0.94**

Comparison data

The table below compares LED lighting to fluorescent lighting in terms of three main metrics: power quality, illumination quality, and economics. The table serves as a reference for Sharin and Idris' (2019) research study findings, allowing for a complete examination and evaluation of the data.

Table 4: Comparison for LED Lighting and Fluorescent Lighting

	Lighting Types / Parameter	LED Lighting		Fluorescent Lighting	
		Value	Rating	Value	Rating
Power Quality	Energy Consumption (Watt)	8	**2**	18	**1**
	Score	**2**		**1**	
Lighting Quality	Average Illuminance (lux)	155	**2**	132	**1**
	Luminous flux/Lumen (Lm)	1350	**2**	1050	**1**
	Score	**4**		**2**	
Economy	Initial Cost (RM)	17.90	**1**	6.40	**2**
	Running Cost (RM)	0.41	**1**	0.94	**2**
	Life Span (Hour)	15,000	**2**	13,000	**1**
	Energy Saving (%)	80	**2**	30	**1**
	Score	**6**		**6**	
	Total Score (Higher the Better)	**12**		**9**	

Table 5: Rating Score Table

Rating Score Table		
Rating	Worse	Best
Score	1	2

CONCLUSION

The study aims to compare LED lighting and fluorescent lighting in Gurun, Kedah household settings in order to discover the best lighting technology for homeowners. The study's findings conclusively indicate LED lighting as the superior option. In terms of power quality, LED lighting surpasses fluorescent lighting, providing higher energy

efficiency and lower power consumption. It also outperforms in terms of illumination quality, with higher brightness, colour rendering, and lighting management. Despite its greater initial cost, LED lighting is more cost-effective due to its longer lifespan and lower maintenance requirements. Homeowners may enjoy well-lit living areas, save energy use, and gain long-term financial benefits by embracing LED lighting.

Finally, this research study shows LED lighting as the best lighting solution for Gurun, Kedah's houses. It is the suggested alternative because to its greater power quality, light quality, and cost-effectiveness. The energy efficiency, lifespan, and fewer maintenance requirements of LED lighting add to its overall cost-effectiveness, making it a more sustainable and ecologically responsible solution. LED lighting allows homeowners to create well-lit and visually appealing living environments while reducing energy consumption and achieving long-term financial benefits. The study's findings provide homeowners with vital insights and help in making educated selections about lighting technology for their residential properties.

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