



Research Paper

Effectiveness Of Lighting system By Using LED Technology In Public And Residential Building

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ABSTRACT

In the earliest days of lighting, power is said to be wasted more due to incapability to select the proper means or method of lightings and this results into high cost of energy in watt-hour, environmental effects and health issue. This paper presents an in-depth study on different types of lighting in public and residential buildings emphasizing much on LED light as compared with other conventional methods in terms of effectiveness in lumen, efficiency, power consumption, and environmental effects. After successful assessment of some selected buildings as samples in the study area, the result has indicated that the proposed lighting system is most suitable and safe to use in the modern time as compare to other system as presented in the results.

KEYWORDS: Lightings, Public, Residential, Buildings Cost, Environmental effects

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I. INTRODUCTION

For thousands of years, people depended on mainly on daylight and fire. The fundamentals of lighting at that time were related to the quantity of light that was to provide light for people to see and manage in the visual environment also during the dark hours. Light is a natural phenomenon vital to our reality. At the beginning of a wide range of electric light sources means we are now less dependent upon light from the sun, moon and stars and flames from combustible fuels. For the time being, the incandescent lamp was invented by Edison in 1882, artificial lighting has explored three phases such as incandescent lamp, neon light, and discharge lamp, and it has been progressing towards the fourth phase like semiconductor lighting, especially white LEDs. White LEDs are already being used in numerous applications like traffic signals, electronic & electrical appliances, mobile phones and full-color video displays. White LEDs are supposed to be the gorgeous green lighting source of the 21st century and show wide usages and considerable potential market. Currently, LEDs are entering the lighting market and as new light sources they enable new methodologies to lighting design and practice. LEDs introduce new opportunities for modifying the color of light and compared to conventional light sources they are small in size giving also freedom for luminaire design. Concerning of power utilization, about 20% of the world's electricity that is generated is used for lighting mainly in buildings and exterior applications. Therefore finding a different kind of solution to maximize the energy efficiency is a timely necessity. According to that lighting is one way of crucial factor of sharing the electricity consumption. Especially most public and private sector organizations use lighting during daytime for their day to day activities. Most researchers have emphasized energy saving systems in different areas which are many ways to measure the „greening“ of a building and associated benefits. The quality, quantity and concentration of light around us expressively affect our visual appreciation of outer environments. It is significant for us to understand the relationship between light, colour, what we see and how we see it. The special persistence of lighting installations is to allow people to satisfactorily fulfill physical or visual tasks, and the effectiveness of performing these tasks correlates to the quantity and the quality of the environment. In the real world lighting setting up should be considered primarily for the comfort of the occupants. The task efficiency, energy efficiency and aesthetic value of the lighting installation are secondary considerations. However, the importance of energy efficiency is greatly increased with issues such as climate change and energy pricing, which all impact our community. Thus, more efficient lighting offers potentially large savings in energy and is closely related to the performances of its control electronics.

1.1 OBJECTIVES

The general objective is to carry out feasibility study on utilizing LED lighting to replace fluorescent lighting in commercial buildings and to compare human performance under those lighting conditions.

The specific objectives of this study are to;

- Determine the power consumption of LED and Incandescent lamp in public and residential buildings.
- Determine the human performance under LED and incandescent compact fluorescent lamp
- Economic analysis of LED in comparison with Fluorescent and incandescent lamps

Determine whether LED technology can successfully replace the existing lighting system

1.1.1 JUSTIFICATION

LED lighting system is currently very popular artificial luminaire among the other systems in the world. But Nigeria, most of the existing lighting systems are used linear and compact fluorescent luminaires. Though very few medium scale level and small scale level manufacturers engage to produce LED lights, no such prepared standards for LEDs. Therefore it is difficult to measure and select required lighting parameters of all produce. Considering those factors, comparison of environmental, technical and economical parameters of LED lighting with other existing systems are very essential to find a better solution.

1.1.2 AIM AND SCOPE

The goal of this study was to calculate, examine and compare the luminous performance, human performance and cost of LED and conventional (linear fluorescent, compact fluorescent and incandescent) lighting systems in the context of the most common luminaire uses in the present environment. This research, aims to introduce LED lighting system and determine the performance and sustainability of the new system.

II. LITERATURE REVIEW

The sense of vision is one of man's most important senses. In order to make use of this sense, we need light that part of the electromagnetic spectrum that gives rise to a visual sensation. This light has to be supplied in sufficient quantities and has to be properly distributed if a situation of maximum visual comfort and performance is to be created. In addition to that, light has important non-visual effects on humans. Since the discovery of a third type of photoreceptor in the human eye is most important (Berson D.M. 2003), researchers have been able to understand more and more how light influences our body's functioning, our health and wellbeing. Especially the influence of light on the circadian system. On the other hand, artificial lighting is accountable for a large part of an office building's electricity needs. In order to reduce this electricity consumption, important efforts have been made during the last decades and will still have to be made in the future. In 2009, Robert Lingard indicated that fluorescent and high-intensity discharge (HID) light sources cannot function without ballast. The ballast provides a starting voltage and limits electrical current to the lamp. Similarly, LEDs require a power supply (commonly called a "driver"). The power supply converts line (AC) power to the appropriate DC voltage (typically between 2 and 4 volts DC for high-brightness LEDs) and current (generally 200- 1000 milliamps, mA), and may also include supplementary electronics for dimming and/or color correction control.

III. METHODOLOGY

In this research, the study area is Geidam and a sample 200 houses will be selected in high power consumption part of the town (low cost area) to represent domestic households and general hospital will represent public buildings making two services sectors.

In 200 houses selected The monthly average electricity consumption will be calculated with the previously used incandescent lamp and with LED lamp, luminaire and glare factor is also taken into consideration, after the computation the final outcome will be compared of the two to realize its effectiveness over time.

In the public building Geidam general hospital as case study is in its development stages as such new buildings will be added to meet space requirements which will significantly increase the electricity consumption in the future. The present indoor lighting system consists of fluorescent lamps and some parts of the buildings with compact fluorescent lamps (CFL). Considering the current situation of the lighting system, the fluorescent and CFL are used mostly for indoor lighting of the hospital. Most indoor lights are switched on during day time therefore the electricity consumption of the lighting system may significantly affect the total energy consumption. Alternative lighting system could be used to improve energy efficiency and minimize the cost of energy consumption.

The relevant measurement of selected area of particular buildings, which including length, width, height, height of work plane, height of room cavity and height of ceiling cavity was taken initially. Then, lumen method formula will be used to determine the average illuminance in the selected area.




IV. RESULTS

The expected outcome or result of this research considering the above risk and adverse health factors and power consumption of the fluorescent lighting condition, LED lighting can be considered as eco-friendly. Even though initial investment of the LED lamp is higher than the fluorescent lamp, there is little or no maintenance cost and very low power consumption cost is an added advantage. LED lamp can also be interconnected with solar power panel due less power consumed. LED lights could be recommended for illumination of even street lights and any decorative lights in future.

Table I: Comparison In Terms Of Efficiency, Lifespan And Material Use.

LIGHT SOURCES	EFF(lumens/Watt)	Lifespan	Toxic material Content
Incandescent Lamps	Low	short	Lead and mercury
Fluorescent Lamps	high	moderate	mercury
Induction fluorescent	high	long	Lead and mercury
MH	high	long	mercury
MV	high	long	mercury
LED		Very long	None

TableII: Comparison In Terms Lumens Only

Light bulb type	Incandescent	CFL	LED
			
Lumens	450LM	4W-5W	9W- 13W
	800LM	6W-8W	13W-15W
	1100LM	9W-13W	18W-25W
	1600LM	16W-20W	23-30W
	2600LM	25W-55W	30W-55W

V. CONCLUSION

It can be ascertain after the assessment or comparison to all type of light bulb used that LED lamps is accepted as the most reliable, cost effective, less power consuming and environmentally friendly lighting system and can be adopted for types of lightings.

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REFERENCES

- [1]. Beral, V., Evans S., Sgaw H. & Milton G., (1982), "Malignant melanoma & exposure to fluorescent lighting at work", The Lancet, pp:290-293.
- [2]. Berson D.M. (2003) Strange vision: ganglion cells as circadian photoreceptors. *TRENDS in Neurosciences*, 26(6):314{320}
- [3]. Bouchet C, Guillemin F, Briancon S (1996) Nonspecific effects in longitudinal studies: impact on quality of life measures. *J ClinEpidemiol* 49:15-20.
- [4]. Boyce, P. R., Cuttle, C., 1990. Effect of correlated color temperature on the perception of interiors and color discrimination performance, *Lighting Research and Technology*, 22 (1), 16-36"
- [5]. Boyce, P. R., 2003. *Human Factors in Lighting*. 2nd ed. London and New York: Taylor & Francis
- [6]. Adair J, Sharpe D, Huynh C-L (1989) Hawthorne control procedures in educational experiments: A reconsideration of their use and effectiveness. *Rev Educ Res* 59:215-228."
- [7]. Adair JG (1984) The Hawthorne effect: A reconsideration of the methodological artifact. *J ApplPsychol* 69:334-345
- [8]. Akashi Y. and Boyce P.R..A(2006), field study of illuminance reduction. *Energy & Buildings*,38(6):588{599}
- [9]. ANSI/IESNA (American National Standard Institute/ Illuminating Engineering Society of North America), 2007.
- [10]. ANSI/IESNA RP-27.1-05: Recommended Practice for Photobiological Safety for Lamp and Lamp Systems – General Requirements. Illuminating Engineering Society of North America Web Store 10 June 2007"

- [11]. BARON, R.A., REA, M.S., DANIELS, S.G. 1992. Effects of indoor lighting (Illuminance and spectral power distribution) on the performance of cognitive tasks and interpersonal behaviour: the potential mediating role of positive affect, *Motivation Emotion*, 16, 1-33."
- [12]. BEAR, A.R., BELL, R.I., 1992. The CSP index: a practical measure of office lighting quality. *Lighting Research and Technology* 24 (4), 215-225
- [13]. Carey A (1967) The Hawthorne studies: A radical criticism. *Am Sociol Rev* 32:403– 416. CIBSE 1997. CIBSE Code for interior lighting 1994: Additions and corrections 1997. ISBN 0 900953 64 0