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EXPERIMENT ANALYSIS OF THOROUGHLY EFFICIENCY OF POWER SAVING LOW COST COMMERCIAL LIGHT SOURCES IN SRI LANKA

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ABSTRACT

Nowadays there are so many light sources are used in the world. But most of consumers are seeking low cost products. Also, they hope to save their electricity. As a result the different LED bulbs were introduced by different manufactures. Nevertheless, people are somewhat ignorant of which product is more suitable for their lighting requirement. When people want to buy LED bulbs, they only consider the price of the product but the quality. Thus consuming more electricity due to unidentified faulties of such cheap products. This study is based on the theme "How to identify better efficient LED bulbs in the local market". Then consumers can buy a low cost and high efficiency LED bulbs. In this study, the different types of LED driver circuits are used for understanding efficiency by varying three parameters; Input voltage, ON time and output voltage. The graphs are plotted for, Input Voltage Vs Efficiency, Input Voltage Vs Output Current and Time Vs Efficiency. Using these graphs, an idea about more efficient and economical bulbs could be obtained. Also, we found that driver circuits come with high power factor ICs are more economical. This study help local LED manufactures in order to produce more energy efficient and qualitative products.

Keywords: Power saving light source, LED, Energy efficiency.

1. INTRODUCTION

Nowadays, there are many types of commercial light sources produced by different companies. Among these, some products are more expensive than the other. Then, customers buy only low cost product but they haven't any idea about its efficiency. In this study, the main background is based on the way to identify what is meant by high efficiency of LED light bulbs and also what are the low cost light sources available in Sri Lanka. There are many researches were done for comparing between LED, CFL and incandescent light source,

as a result generally they have found that the LED light source is the high efficiency light source[1]. So in this study we have only focused LED light sources.

2. METHODOLOGY

Firstly, the type of LED driver circuits available in Sri Lanka was identified and an idea about their operation could be obtained. The study was done by using the different LED driver circuits with the same output power.

LED driver circuit was connected to the variable output voltage transformer. And the other end of the driver circuit was connected to the LED panel. After that input Voltage (AC), input current (AC), output voltage (DC) and output current (DC) were measured. Data was recorded by varying the input voltage. Also the same driver circuit was connected to the main supply and it was recorded the above data by varying only time intervals in minutes.

Above steps were done for all driver circuits and their inputs and outputs power were measured. Then the efficiency of LED driver circuits was calculated and the graphs were plotted[2] for Analyzing purpose.

Graphs are

- Input voltage vs efficiency
- Input voltage vs output current
- Time vs efficiency

Finally with the use of these graphs, the most efficiency and low cost driver circuit was identified.

2.1 Efficiency calculation

An efficiency is determined by comparing its input power to its output power using the equation [1]. More precisely, the efficiency of the converter is calculated by dividing the output power by its input power.

$$\eta = \frac{Pout}{\text{Pin}} \qquad [1]$$

Where, Pout is output power, Pin is input power and η – efficiency [3].

Electric power, like mechanical power, is the rate of doing work, measured in watts. The electric power in watts produced by an electric current (I) consisting of a charge of Q coulombs every t seconds passing through an electric potential (voltage) difference of V. can be express on equation [3].

$$I = \frac{Q}{t} \qquad [2]$$

Where, Q is electric charge in coulombs, t is time in seconds and I is electric current in amperes[4]

$$P = VI \qquad [3]$$

Where, V is electric potential or voltage in volts, P is work done per unit time and I is electric current in amperes[3].

2.2 The LED driver circuits concerned for the study

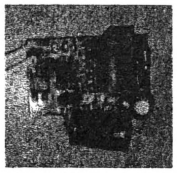

Figure 1: Circuit 1; with cs8211 IC, 4.7µf 400V capacitor and 22µf 50V capacitor

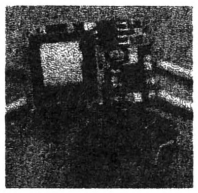

Figure 2: Circuit 2; with TV3218 and 4.7µf 400V capacitor

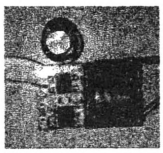

Figure 3: Circuit 3; with AP3122C IC, 4.7µf 400V capacitor

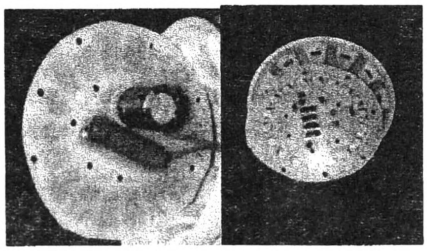

Figure 4: Circuit 4; only used capacitor and resistors

3. RESULTS AND DISCUSSION

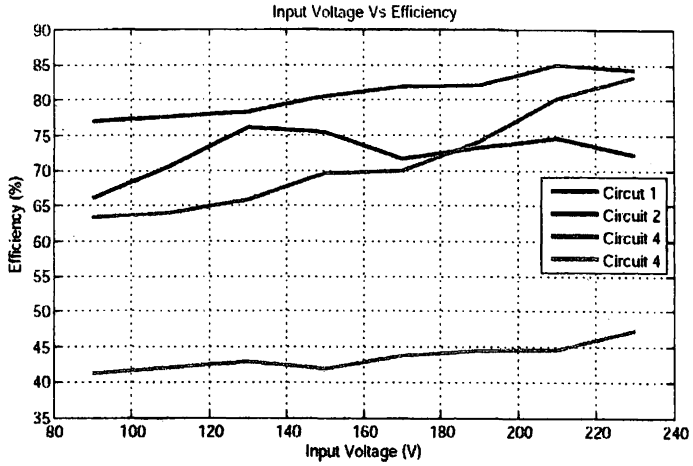

Figure 5: The graph of input voltage (V) Vs efficiency (%) for all 4 concerned circuits

According to the above graph, the circuit 1can be chosen as the most efficient one, because the efficient we calculated is high for all the input voltage levels. And also the circuit 2 is more efficient than circuit 3 and circuit 4. But at the input voltage around 180, the circuit 3 is more efficient than circuit 2 and circuit 4. The circuit 4 is not a good one because of its low efficient at all input voltage levels.

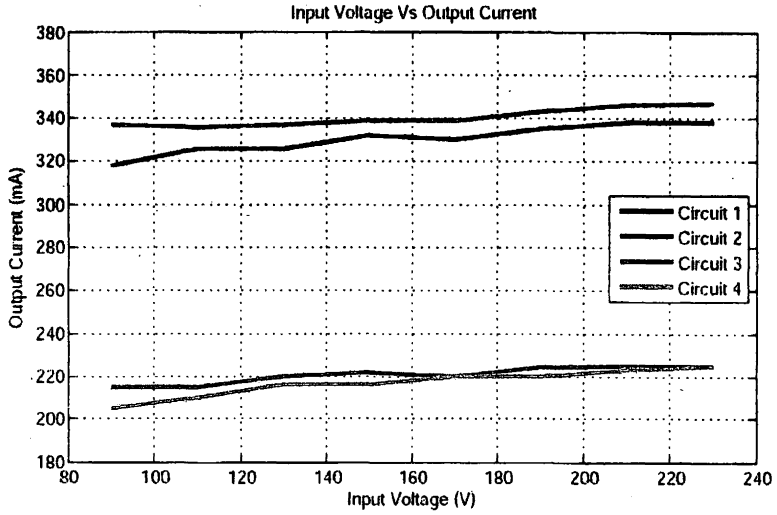

Figure 6: The graph of input voltage (V) Vs. output current (mA) for all concerned circuit

In the above graph, circuit 1 and circuit 3 have close values for the output current. Same as the circuit 2 and circuit 4 have close relation in values for the output current.

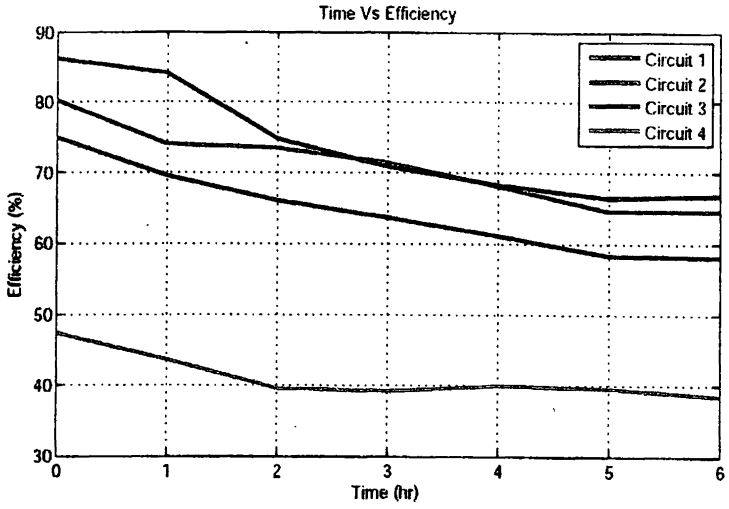

Figure 7: The graph of time (minutes) Vs efficiency (%) for all concerned circuit

By considering above graph it can be observed that all the circuit's efficiency level go to low level with the increasing of the time interval. But circuit 1 and circuit 3 have same efficiency level during two and four time intervals. But circuit 1's efficiency is increasing after the four time interval.

By referring the above result of this research, users can gain an idea of which type of LED bulbs are suitable for their purposes. And also the new inventers can get an idea of which type of LED driver circuit will be developed in the future.

The research was done by considering limited number of parameters to measure the efficiency. In some cases the manufactures do not allow to get circuit details of the driver circuit. Therefore, in this stage, there is no facilities to detect other parameters which are affected to the LED bulb efficiency due to that unavailability of the datasheet as well as the unavailability of sophisticated experimental equipment.

1. CONCLUSION

Nowadays there are many kind of LED light bulbs in the market. But they are not efficient up to their boasting advertisements. Reason is that, there are different kind of circuit designs available in local market but most of these designs are not efficient or they are cheap products. So people cannot get an idea about efficiency of light sources. The most of consumers adapt to buy low cost LED bulbs but that is not a good practice. By referring this type of research study, consumers in Sri Lanka will be able to buy somewhat higher efficiency light sources as well as such low cost products.

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