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COMPARATIVE ANALYSIS OF MODERN LED LAMPS

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The most popular types of LED lamps among local people are considered in this article. The most economical type in everyday life is presented in this research.

У статті розглядаються найпопулярніші види світлодіодних ламп серед місцевого населення. Найбільш економічний тип у повсякденному житті представлений у цьому дослідженні.

Problem setting. One of the root causes of the current crisis on Ukraine is the state of the local energy sector. Ukraine has the highest electricity prices in Europe. As for the previous year 2017 the price was 0.6 hrn, and it was raised to 0.75 hrn this year. As we know the LEDs provide energy-efficient lighting which lessen the burden on non-renewable energy sources and lower the utility bills. LEDs are the most efficient lights in the market; they began to appear alongside incandescent and compact fluorescent bulbs in home-goods stores and hardware. The working of the LEDs is different from the standard bulbs [2]. Thus, we have been interested in the most economical type of LEDs among local people.

Analysis of recent research and publications. According to this information source [1], the practical implementation of LEDs originated from the experiment of Henry Josef Round, a radio engineer in Marconi Labs, who observed the emission of light from a silicon carbide crystal when a current flowed through the material. This was the very first demonstration of a solid-state lighting, and the light produced is based on an electroluminescence effect (Round 1907). In spite of this breakthrough, technological advancement of LEDs was relatively slow until the 1960s (Schubert 2003). Since the invention of the first commercial LED in the late 1960s, there has been a gradual improvement in LED design with the advancement of semiconductor technology. The new-generation LEDs have also become a promising light source, besides its popular applications as indicators and optoelectronic devices.

The purpose of the article is to consider the popular types of LED lamps, and to present the most economical LED lamp in everyday life among the local people.

Basic material research. LEDs are known as solid-state light sources because they emit light from a semiconductor diode chip. We found the another definition of the LED lamp, it is an electric light or light bulb for use in light fixtures that produces light using light-emitting diodes (LEDs). James Biard and Gary Pittman (1961) of Texas Instruments accidentally discovered the emission of infrared radiations from gallium arsenide (GaAs) semiconductor upon the passage of electricity, while working on solar cells. They patented the design as "semiconductor radiant diode" in 1962, and that was the world's first light-emitting diode (LED) [1].

LED lamps have a lifespan and electrical efficiency which are several times greater than incandescent lamps. Like incandescent lamps and unlike most fluorescent lamps (e.g. tubes and compact fluorescent lamps or CFLs), LEDs come to full brightness without need for a warm-up time; the life of fluorescent lighting is also reduced by frequent switching on and off. Some LED lamps are made to be a directly compatible drop-in replacement for incandescent or fluorescent lamps. An LED lamp packaging may show the lumen output, power consumption in watts, color temperature in kelvins or description (e.g. "warm white"), operating temperature range, and sometimes the equivalent wattage of an incandescent lamp of similar luminous output [2].

Most LEDs do not emit light in all directions, and their directional characteristics affect the design of lamps, although omnidirectional lamps which radiate light over a 360° angle are becoming more common [1]. There is a wide variety of uses for LED products and LED Lights, few that

you would have never even thought of before. Mainly LED Lights can be used for entertainment, home applications, events, signage, boat, business applications, and automobile applications, and it works even as enhancements to art work or LED Lights as art work themselves [2].

It was found that incandescent lamp is an electric light with a wire filament heated to such a high temperature that it glows with visible light (incandescence). The filament is protected from oxidation with a glass or fused quartz bulb that is filled with inert gas or a vacuum. Incandescent bulbs are manufactured in a wide range of sizes, light output, and voltage ratings, from 1.5 volts to about 300 volts. Incandescent light bulbs are still a remarkably widespread method of lighting but other types of light bulbs (like LED and CFL) are growing more popular. This shift is due to the extreme inefficiency of incandescent bulbs as they only convert about 10% of the electrical energy they receive into visible light, with the rest being dissipated as heat. The incandescent bulb is widely used in household and commercial lighting, for portable lighting such as table lamps, car headlamps, and flashlights, and for decorative and advertising lighting. Incandescent light bulbs consist of an air-tight glass enclosure (the envelope, or bulb) with a filament of tungsten wire inside the bulb, through which an electric current is passed [3].

We have compared two kinds of lamps in our experiment: LED lamp (three companies) and incandescent lamp. We have investigated how much more economical is the LED lamp than an incandescent lamp. You can see their electrical characteristics in Table 1.

Characteristics	“WATG”	“Delux”	“LED”	Incandescent lamp
Term of the work	30000 h	25000 h	30000 h	1000 h
Voltage	220-240 V	230 V	175-250 V	220-230 V
Frequency	50-60 Hz	50 Hz	50-60 Hz	50-60 Hz
Power	8 W/h	5 W/h	4 W/h	100 W/h
Price on the site “Rozetka”	85 hrn (UAH)	75 hrn (UAH)	53 hrn (UAH)	8 hrn (UAH)

Table 1. The electrical characteristics of LED lamps (three companies) and incandescent lamp and their price.

We have figured which light bulb is more profitable. We used the prices for electricity in Ukraine for January month = 0,75 hrn (UAH) for 1 kW / h. You can see this comparison in Table 2.

	“WATG”	“Delux”	“LED”	Incandescent lamp
Power (kW/h)	0,008 kW / h	0,005 kW/ h	0,004 kW / h	0,1 kW / h
Money (spent per hour)	0,006 hrn (UAH)	0,0037 hrn (UAH)	0,003 hrn (UAH)	0,075 hrn (UAH)
Money (spent per day) (12h/day)	0,072 hrn (UAH)	0,045 hrn (UAH)	0,036 hrn (UAH)	0,9 hrn (UAH)
Money (spent per month) (12h/day)	2,16 hrn (UAH)	1,332 hrn (UAH)	1,08 hrn (UAH)	27 hrn (UAH)

Table 2. The comparison characteristics of LED lamps (three companies) and incandescent lamp and their prices.

Table 2 shows a significant difference in power and costs between LED lamps and incandescent lamp.

Conclusion. Our work has led us to the conclusion that the LEDs are the most efficient lights in the market nowadays and the LED lamp is more economical one than any incandescent lamps. And the most profitable one is the lamp of LED Company.

References

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