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Role of Electronics In Conservation of Electricity Using LED In Daily Usage: An Empirical Study In Higher Education Institute In Ajmer

Divya Bansal, Vijay Laxmi Kalyani

Divya Bansal, pursuing B.TECH (VII Sem,) ECE Branch, Govt. women engineering college, Ajmer, Rajasthan, India
divyabansal117@gmail.com
Vijay laxmi Kalyani, Assistant professor (ECE department) Govt. women engineering college, Ajmer, Rajasthan, India
vijaylaxmikalyani@yahoo.com

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Abstract: Nowadays, due to the rapid development of LED technology, the conventional energy sources like incandescent and fluorescent lamps are rapidly replacing by LED bulb and LED tube lights. For this purpose, the Government has also taken various initiatives to replace the incandescent and fluorescent lamps etc. by LED lights. Therefore, in this paper, the author(s) has presented a new approach about saving of electricity and reducing power consumption by the usage of LED tube lights and LED bulbs. For this purpose, the author(s) has done a survey in a higher educational institution of Ajmer and calculated the monthly & yearly power consumption of tube lights, incandescent bulbs, halogens and CFLs located in that institute. The survey reveals that if all the incandescent bulbs, tube lights and halogens which are energy inefficient; are replaced by LED lights than the power consumption can be minimized and hence the electricity bill can be lowered. In this paper, the author(s) have also designed a project which shows how the energy can be conserved using LED bulb and how this project can be helpful to the physically impaired people.

Key words: LED, tube light, incandescent bulb, CFLs, halogen, Survey, clap switch circuit.

I. INTRODUCTION

Electricity plays a vital role in improving the quality of life. It is a form of energy which we utilize in our daily life. Energy can be neither created nor destroyed but it can be transformed from one form into another form. We get electricity from various kinds of sources like wind energy, hydro power, chemical energy, nuclear energy, solar energy, tidal energy etc. The conservation of energy is an important means to reduce peak and average demand of energy. Conservation of electricity is more essential due to the concern for fast depletion of non-renewable sources of energy in the country. It is necessary to save the environment and the Earth from global warming [1].

For conservation of energy, electronics play an important role. Electronics is the science of controlling electrical energy electrically, in which the electrons play a fundamental role. It is the branch that deals with electrical circuits that involve active electrical components (such as vacuum tubes, transistors, diodes, integrated circuits, optoelectronics, and sensors), associated passive electrical components, and interconnection technologies. One of the technology advancement in electronics is LED lights. With the help of LED lights we can save the power consumption and reduces the cost of monthly bill of electricity. Therefore, in this paper firstly, the author(s) present a new approach about saving of electricity and reducing power consumption in higher educational institute of Ajmer by the usage of LED tube lights and LED bulbs. For this purpose, the author(s) has done a survey in a higher educational institution of Ajmer and calculated the monthly & yearly power consumption of tube lights, incandescent bulbs, halogens and CFLs located in the campus of that institute. The survey reveals that if all the light sources which are energy inefficient; are replaced by LED lights than the power consumption can be minimized and hence the electricity bill can be lowered. In this paper, the author(s) have also designed a project based on clap switch circuit which shows how the energy can be conserved using LED bulb and how this project can be helpful to the physically impaired people.

II. ROLE OF ELECTRONICS IN CONSERVATION OF ELECTRICITY USING LED IN DAILY USAGE

One of the biggest technology advancement in the field of electronics is LED lighting. LED lighting plays an important role in our daily lives. It can minimize the negative effects of regular conventional bulbs on the environment. LEDs can be very beneficial in street lighting, traffic lights, tunnel lighting, emergency lighting, televisions, smart phones, places etc. means that LED technology is everywhere. Use of LED lights has reduces consumption of energy and lower down the monthly electricity bill.

LED lights are up to 80% more efficient than traditional lighting such as fluorescent and incandescent lights. 95% of the energy in LEDs is converted into light and only 5% is wasted as heat. This is less as compared to fluorescent lights

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which convert 95% of energy to heat and only 5% into light. LED lights also draw much less power than traditional lighting. A typical 84 watt fluorescent can be replaced by a 36 watt LED to give the same level of light. Less energy use reduces the demand from power plants and decreases greenhouse gas emissions [2].

III. DIFFERENT TYPES OF LIGHTING SOURCES USED FOR ENERGY CONSERVATION

Lighting consumption constitutes about 30 % of residential consumption as per a study by Ministry of Environment and Forest in India. Its contribution in the electricity bill may vary from 10-20 % depending on the total bill of the user. Latest technical advancements in lighting offer many options for saving energy today. The energy saving options today are more expansive as compared to the old incandescent bulbs and tube lights, but the life of the new energy saving lighting options are much better than the lights, which makes them more suitable to be used for daily usage. There are several lighting options available in the market:

1) Incandescent bulb: The incandescent light bulb or lamp is a source of electric light that works by incandescence, which is the emission of light caused by heating the filament. Incandescent bulbs are manufactured in a wide range of sizes, light output, and voltage ratings, from 1.5 volts to about 300 volts. The traditional yellow light bulbs which were available in various variants: 40 W, 60 W and 100 W, are the most efficient in terms of energy consumption. 90 % of the energy they consume is lost in the form of heat and only 10 % of energy is converted into useful light. Although they are quite inexpensive but they consume more energy as compared to CFLs and LED bulbs. Measures to ban light bulbs have been implemented in the European Union, the United States, Russia, Brazil, Argentina, Canada and Australia, among others. The initial cost of an incandescent bulb is small compared to the cost of the energy it uses over its lifetime. Incandescent bulbs have a shorter life than most other lighting, an important factor if replacement is inconvenient or expensive. Incandescent bulbs are much less efficient than most other types of electric lighting; incandescent bulbs convert less than 5% of the energy they use into visible light, with standard light bulbs averaging about 2.2%. The remaining energy is converted into heat [3].

Fig.1 Incandescent bulb
Source: https://en.wikipedia.org/wiki/Incandescent_light_bulb

2) Tube lights: The fluorescent lamps are better than incandescent bulbs (50-70% better in providing same amount of light). It started coming in the form of tube lights and later modified to come in the form of CFLs. A typical fluorescent lamp has ballast and a tube. The efficacy of fluorescent tubes ranges from about 16 lumens per watt for a 4 watt tube with an ordinary ballast to over 100 lumens per watt with a modern electronic ballast, commonly averaging 50 to 67 lm/W overall. Most compact fluorescents above 13 watts with integral electronic ballasts achieve about 60 lm/W. Typically a fluorescent lamp will last 10 to 20 times as long as an equivalent incandescent lamp when operated several hours at a time. Under standard test conditions general lighting lamps have 9,000 hours or longer service life. The higher initial cost of a fluorescent lamp compared with an incandescent lamp is usually more than compensated for by lower energy consumption over its life. Tube lights are also available in various variants: T12, T8 and T5. These numbers represent the thickness of the tube light. The smaller the number, the higher the efficiency. T5 tube lights with electronic ballast are the best available tube light in the market. A T12 tube light with electromagnetic ballast consumes 55 W of electricity but a T5 tube light with an electronic ballast consume only 28 W of electricity (comparison for a 4 feet tube light). Thus a T5 provides about 50 % electricity saving over a T12 tube light. T8s are typically 38 W tube lights and are better than T12s. Their life expectancy is good and they last for 3-4 years at least. Because fluorescent lamp contains mercury, many fluorescent lamps are classified as hazardous waste. Fluorescent lamps are a non-linear load and generate harmonic currents in the electrical power supply. They are long, low-luminance sources compared with high pressure arc lamps, incandescent lamps and LEDs [4].

Fig.2 Tube light
Source: www.fireflygn.com

3) Compact Fluorescent lamp (CFLs): CFLs are highly versatile and can be used in any setting that you would normally use incandescent bulbs. The lamps use a tube which is curved or folded to fit into the space of an incandescent bulb, and a compact electronic ballast in the base of the lamp. CFLs have been regarded as the best energy saving option in India since quite some time. CFL is a variant of fluorescent lamps but has a different application. CFLs act as a point source of light whereas tube lights are

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line sources (tube lights have bigger lengths) and thus the area covered by tube lights is more than that of CFLs. This is the reason why a lot of people feel that CFLs produce lesser lights than tube lights. Even with equal wattage (2x14 W CFLs) the amount of light is felt lesser than a T5 tube light (of 28 W) because of CFL acts a point source [3]. CFLs typically have a rated service life of 6,000–15,000 hours, whereas standard incandescent lamps have a service life of 750 or 1,000 hours. However, the actual lifetime of any lamp depends on many factors, including operating voltage, manufacturing defects, exposure to voltage spikes, mechanical shock, frequency of cycling on and off, lamp orientation, and ambient operating temperature, among other factors. CFL lamps have lighting efficiency ranges of 7–10%, versus 1.5–2.5% for incandescent. While the purchase price of a CFL is typically 3–10 times greater than that of an equivalent incandescent lamp, a CFL lasts 8–15 times longer and uses two-thirds to three-quarters less energy. CFL are compact in size. They provide up to 70 % energy savings over a typical incandescent bulb. When CFLs are used outdoors they must be covered and protected from the elements. They are also sensitive to temperature, and low temperatures can cause lower light levels [5]. The major drawback of CFL is that they contain mercury. While this element is not toxic or dangerous when the bulbs are being used, it will surely be if the bulbs are broken and not disposed correctly.

Fig.3 Compact fluorescent bulb (CFL)
Source: www.dir.indiamart.com

4) Light emitting Diode (LED): LEDs are the latest and most efficient lighting option which is available in the market. Their electricity consumption is 50 % less than that of CFLs and fluorescent lamps for the same amount of light. LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. LEDs are long lasting with a life of about 10-25 years and their performance remains the same throughout their lifetime (Tube lights and CFLs get dim with time). Although LEDs are little expensive, the benefit with LEDs is that it is maintenance free. Once installed, it will not need any repair of change for at least 10 years [3]. Typical indicator LEDs are designed to operate with no more than 30–60 milli watts (mW) of electrical power. LEDs can be very small (smaller than 2 mm^{2}l) and are easily attached to printed circuit boards. LEDs can have a relatively long useful life of about 35,000 to 50,000 hours. LEDs, being solid-state components, are difficult to damage with external shock, unlike fluorescent and incandescent bulbs, which are fragile. The advantage of LEDs is that it light up very quickly as compared to incandescent bulbs and tube lights.

Fig.4 LED Bulb
Source: www.philips.co.uk

IV. INTRODUCTION OF LIGHT EMITTING DIODE

LED are classified as electro- luminescent devices that are composed of semiconductor material that are capable of generating light when they are forward biased by a current source. It is a device which converts electrical energy into light energy. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are like tiny light bulbs. They require a lot less power to light up. They're also more energy efficient. This makes them ideal for mobile devices and other low-power applications.

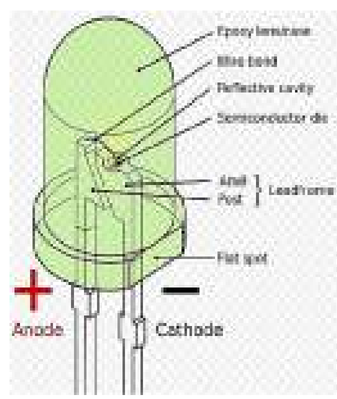

Fig.5 Light Emitting Diode
Source: en.wikipedia.org

LEDs produce more light per watt than incandescent bulbs; this is useful in battery powered or energy saving devices. It can emit light of an intended colour without the use of colour filters that traditional lightning methods require. This is more efficient and can lower initial costs [6].

V. COMPARISON CHART: LED LIGHTS VS INCANDESCENT LIGHT BULBS VS TUBE LIGHT VS CFLs

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Energy Efficiency & Energy Costs	**Light Emitting Diode (LEDs)**	**Incandescent Light bulb**	**Tube light**	**Compact Fluorescent Lamp (CFLs)**
Life span (average)	~50,000 hours	~1,200 hours	~9000 hours	~8,000 hours
Watts of electricity used	6-8 watts	60 watts	40 watts	13-15 watts
Kilo-watts of Electricity used (using one light source for 5 hours per day)	10.90 KWh/yr	109.50KWh/yr	73.00KWh /year	25.50 KWh/yr
Annual operating cost (for one light source)	$ 1.09/ year	$10.95/year	$7.30/year	$2.55/year
Environmental Impact	**Light Emitting Diode (LEDs)**	**Incandescent light bulbs**	**Tube light**	**Compact Fluorescent Lamp (CFLs)**
Contains the TOXIC Mercury	No	No	Does contain mercury and phosphorus	No- Mercury is very toxic to your health and the environment
Carbon dioxide emissions (30 bulbs per year)	15.03 pounds/year	150.00 pounds/year	100.00 pounds/year	35.3 pounds/year
Important Facts	**Light Emitting Diode (LEDs)**	**Incandescent Light Bulbs**	**Tube light**	**Compact Fluorescent Lamp (CFLs)**
Sensitivity to temperature	None	Moderate	Yes	Yes- may not work under negative 10 degrees Fahrenheit or over 120 degrees Fahrenheit
Sensitive to humidity	No	Moderate	Moderate	Yes
On/Off cycling	No effect	Moderate	Moderate	Yes-can reduce lifespan drastically
Turns on instantly	Yes	Yes	Depends on type of ballast used	No-takes time to warm up
Durability	Very durable-LEDs can handle jerk, vibration & shake	Not very durable-glass of filament can break easily	Not durable	Not very durable-glass can break easily
Failure Modes	Not typical	Some	Depends on their use and control gear type	Yes-may catch on fire, smoke, or omit an odour
Light Output	**Light Emitting Diode (LEDs)**	**Incandescent Light Bulbs**	**Tube light**	**Compact Fluorescent Lamp (CFLs)**
Lumens	800	860	Depend on type of model used	775
Luminous Efficacy	81-300 lumens/watt	14.5 lumens/watt	50-100 lumens/watt	60 lumens/watt

Table 1: Showing the comparison between LED, incandescent bulb, tube light and CFL

VI. GOVERNMENT POLICIES FOR LED LIGHTING IN INDIA

India is a country where a major part of the population is not connected to the power grid. In order to supply power to them, India will need to create either newer sources of power or reduce the power demand by implementing energy-efficient devices at all levels. It has been estimated that, in India, lighting systems consume 18 % of total power consumption, which is considered high when compared to other countries, where lighting consumption is approximately 12 to 14 percent. Due to this, light emitting diode (LED) has emerged as an important energy-efficient device, especially for lighting systems.

The shift toward renewable energy, demand for energy efficient products and LED appliances has increased. Several important features of LED, like long lifespan, energy-saving capacity [which is more than 50 % as compared to CFL bulb] and absence of toxic materials, are some factors that make LEDs more affordable, informs Harmeet Singh, technical lead, Analogue Applications, TI India. With LEDs, we can save approximately 80 % of energy as compared to normal lighting devices. LEDs have a longer life in comparison to normal lighting devices or even CFLs. In general, life of an LED is approximately 25,000 burning hours, whereas ordinary lights last around 5000 to 6000 burning hours. Extra cost of maintenance or replacement will not be incurred for a long period of time.

The Indian market for LEDs has shown a steady growth over the last few years. Newly formed government in India has emphasized that each and every house hold should have a light bulb by 2019, creating huge demand for power by 2019. Street lighting and industrial and commercial applications are boosting the market in India. According to ELCOMA reports, there are about 27.5 million street-lighting points in India that will be converted to LED in a phased manner. The government of Andhra Pradesh has announced that it will be distributing LED light bulbs to 3.7 million households in Andhra Pradesh at a cost of Rs. 10(US $0.16 approx), which is usually cost approximately $6.

LED standards were published in 2012, according to which custom duty on LED was reduced from 10% to 4% as a part of government of India initiatives. Government of India through its energy-development agencies in various states is

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promoting a lot of projects where they are going to replace the existing lighting systems with LED [7].

VII. VARIOUS INITIATIVES TAKEN BY GOVERNMENT TO PROMOTE LED LIGHTING

1. Government LED program to support Make in India: Domestic Efficient Lighting Program.The replacement of LEDs will save $5.9 billion in bills and result in savings of 100 million kWh of energy. An initiative that can change the electricity sector in India “domestic efficient lighting programme”, launched by Prime Minister Shri NarendraModi on 1 May 2015 has played an important role in creating awareness about the use of LEDs in all the developing countries and has given a huge contribution in the “Make in India” initiative.

As of January 2017, 21 crore LED bulbs have been distributed across the country under this initiative which has saved 25.8 crore every day in cost and a reduction of 52,728 ton of CO_2. EESL (Energy Efficiency Services Limited) is one of the major players for the enterprise and is obtaining bulbs from manufacturers at rates lower than that in the market. The bulbs are distributed to customers who register through the website or by sending SMS to the labelled number. The initial payment is Rs. 10 and the rest amount is recovered through electricity bill, Rs. 10 for the next 12 months. This makes it easier for people especially in rural areas and as a result we can see the surge in LED bulbs over the last few years. The government is providing LED bulbs for a mere price of Rs. 130 which is around 250 % less than the average market price to acquire a LED [8].

2. Launch of energy efficient lighting initiatives in Varanasi by Shri Piyush Goyal In a major initiative at promoting energy efficiency in the city of Varanasi, Shri Piyush Goyal, Union Minister of Steel (IC) Power, Coal and New & Renewable Energy has launched Domestic Efficient Lighting Programme (DELP) and LED-Based Smart Street Light Programmes in Varanasi in June 2015 in the presence of Shri Yassir Shah, Minister of Energy, and Government of UP. Launch of these initiatives heralds the government’s pledge to cut down energy usage by 10,000 MW during peak hours by promoting LED lights across the nation. Central and State Government in association with Energy Efficiency Services Limited (EESL), a public sector entity under Ministry of Power, will distribute about 13 lakh LED bulbs to 2,28,496 Domestic Consumers, and replace 36,077 conventional street lights with energy efficient LEDs in Varanasi.

EESL in cooperation with Purvanchal Vidyu tVitaran Nigam Limited (PUVVNL) will also implement Domestic Efficient Lighting Programme across the city. The LED distribution programme will distribute about 13 lakh LED bulbs to grid-connected domestic consumers in Varanasi. Under DELP, each household having connected load of less than or equal to 2kW will be provided with up to five 7 – Watt high quality LEDs bulbs at an initial payment of Rs. 110 each over a period of 11 months from electricity bills. A household can purchase a LED bulb at an overall cost of 120 as against the retail price of Rs. 350-600 along with 3-years free replacement warranty. It is estimated that households will benefit Rs.162 per annum as savings in electricity bill (at current average tariff) for each LED bulb, exceeding Rs.120 purchase cost per LED.

The combined impact of the Government’s two initiatives could help Varanasi achieve energy savings to the tune of nearly 104 million kWh annually. This translates to a total cost savings of about Rs. 68 Cr per annum. Announcement of these programmes follows Honourable Prime Minister Shri Narendra Modi’s pledge of,” wholehearted commitment towards energy conservation” and is aimed at realizing his vision of “24 x 7 affordable power for all [9].

3. UJALA Scheme: Free LED Bulb Yojana

Unnat Jyoti by Affordable LEDs and Appliances for All (UJALA) was launched by Prime Minister of India Narendra Modi on 1st May 2015, replacing the "Bachat Lamp Yojana". Within 1 year of its launch, 9 crore LED bulbs were sold in the country, reducing their electricity bills by 55 billion (US$860 million) [10].

Fig.6. Prim Minister of India with LED Lamp
Source:http://www.pmindia.gov.in/wp-content/uploads/2015/01/s2015010560709.jpg

The main aim of the Yojana is to switch the usage of over 200 million incandescent light bulbs into LED bulbs. This will save a power of 10.5 billion kWh as a whole. It is offering free and affordable LED light bulbs to all. It is one of the first and the strongest measures taken by the central government to promote the usage of efficient light bulbs. The aim of the scheme is to preserve the environment.

Under this scheme the LED bulbs are made available at cheaper rates than the market price. At present the market rate of a common household LED bulb Rs.160. Under this scheme a person will get the same LED bulb for Rs. 85. It is important to note that the 9W bulbs are available for Rs. 85. Also all the bulbs purchased under this programme have a 3 year replacement warranty [11].

VII.I. SURVEY DONE IN A PARTICULAR HIGHER EDUCATION INSTITUTE IN AJMER

The author (s) has done an empirical study in the higher education institute in Ajmer, Rajasthan. For this purpose, the author has conducted a survey in which total number of tube lights, bulbs, CFLs and halogens have been calculated in the campus of higher education institute in Ajmer. It is observed

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that tube lights, bulbs, CFLs lights remains in operation at day time from 9 AM to 4 PM. It is also observed that the duration of operation may slightly vary depending on need of light according to the direction of sunlight and on the seasonal change of day length. The total working hours of the institution is 7 Hours/Day and it is observed that the maximum time for consumption of light in a day is approx. 6 hours. So the calculations are done as per the consumption of light in a day (approx. 6 hours). It is found after survey that in a campus there is total number of tube lights are 472, CFLs are 178 and Halogens are 60 in which halogens are remains in operation in night time in campus because these are mainly located in corridors of campus or in some particular locations of campus. After calculation it is observed that the total amount of uses of light sources is Rs 4, 07,808.00 per year spend by the institute. When if we replace these light sources into LED light than the power consumption of light will be Rs 1, 83,513.60/- per year. Therefore the total saving of amount of electricity bill will be Rs 4, 07,808.00 - Rs 1, 83,513.60 = Rs 2, 24,294.40/- per year. Hence, if all the tube lights are replaced by LED tube lights of 18 W in higher education institute, than we can save about Rs 2, 24,294.00 per year.

VII.II. METHODOLOGY OF SURVEY

- Total number of rooms has been counted.
- Total number of tube lights, halogens, bulbs and CFLs in each room has been counted.
- Total number of units consumed by tube lights, halogens, bulbs and CFLs per month in each room has been counted.
- Total power consumed by tube lights, halogens, bulbs and CFLs in each room per month has been counted.
- Total amount paid by institute per month has been calculated.
- Total amount paid by institute per year has been calculated.

1.

S.no.	Room number	Number of halogens	Number of tube lights	Number of bulbs	Number of CFLs
1.	ELECTRIC MACHINE LAB	-	34	-	-
2.	L-105	-	10	-	-
3.	L-106	-	10	-	-
4.	CORRIDORS (GROUND FLOOR)	05	01	-	36
5.	T-102	-	02	-	-
6.	L-103	-	08	-	-
7.	L-104	-	08	-	-
8.	F-103	-	02	-	-
9.	F-107	-	01	-	01
10.	F-108	-	01	-	01
11.	F-109	-	01	-	01
12	F-101	-	02	-	01
13.	PHYSICS LAB	-	09	-	-
14	DARK ROOM	-	03	-	-
15.	F-102	-	02	-	-
16.	L-102	-	07	-	-
17.	L-101	-	08	-	-
18.	T-101	-	02	-	-
19.	F-101	-	02	-	-
20.	L-202	-	08	-	-
21.	L-201	-	07	-	-
22.	F-201	-	02	-	-
23.	T-201	-	02	-	-
24.	P-201	-	06	-	-
25.	P-202	-	06	-	-
26.	T-202	-	02	-	-
27.	L-205	-	09	-	-
28.	P-201	-	06	-	-
29.	F-202	-	02	-	-
30	F-203	-	01	-	-
31.	F-204	-	01	-	-
32.	F-205	-	01	-	-
33.	P-205	-	06	-	-
34.	P-206	-	06	-	-
35.	P-207	-	06	-	-
36.	P-208	-	06	-	-
37.	P-209	-	06	-	-
38.	F-206	-	01	-	-
39.	F-207	-	01	-	-
40.	F-208	-	01	-	-
41.	F-209	-	01	-	-
42.	F-210	-	01	-	-
S.no	Room number	Number of halogens	Number of tubelights	Number of bulbs	Number of CFLs
43.	L-203	-	08	-	-
44.	CORRIDOR I FLOOR	-	02		32
45.	UPS ROOM	-	02	-	-
46.	T-303	-	04	-	-
47.	F-308	-	01	-	-
48.	F-309	-	01	-	-
49.	F-310	-	01	-	-
50.	F-312	-	01	-	-
51.	L-302	-	10	-	-
52.	L-301	-	10	-	-
53.	DRINKING WATER	-	01	-	-
54.	F-311	-	01	-	04
55.	CORRIDOR II FLOOR WASH ROOM	-	-	-	08
56.	F-303	-	01	-	-
57.	F-304	-	01	-	-
58.	F-305	-	01	-	-
59.	F-306	-	01	-	-
60.	F-307	-	01	-	-
61.	UPS ROOM	-		-	-
62.	T-302	-	03	-	-
63.	L-303	-	12	-	-
64.	FACULTY WASHROOM	-	-	-	-
65.	DRINKING WATER	-	-	-	-
66.	CORRIDOR II FLOOR	-	-	-	-
67.	F-302	-	01	-	-
68.	P-305	-	06	-	-
69.	T-301	-	02	-	-
70.	UPS ROOM P-302	-	06	-	-
71.	P-303	-	06	-	-
72.	SH-301	07	-	-	-
73.	PARAM COMPUTER CENTER	-	-	-	-

	LAB A,B	08	-	-	-
	LAB C.D	08	-	-	-
74.	F-301 SERVER ROOM	01	-	-	-
SHIVALIK BHAWAN					
S.no.	Room number	Number of halogens	Number of tube lights	Number of bulbs	Number of CFLs
75.	L-107	-	09	-	-
76.	L-108	-	09	-	-
77.	L-109	-	09	-	-
78.	L-110	-	09	-	-
79.	L-207	-	09	-	-
80.	L-208	-	09	-	-
81.	L-209	-	09	-	-
82.	L-210	-	10	-	-
83	GROUND CORRIDOR	-	13	-	-
84.	FIRST FLOOR	-	13	-	-
85.	STORE ROOM	-	01	-	-
LEFT SIDE OF AUDITORIUM					
S.no	**Room number**	**Number of halogens**	**Number of tube lights**	**Number of bulbs**	**Number of CFLs**
86.	PROCTOR SECTION	-	04	-	-
87.	ACCOUNT SECTION	-	04	-	-
88.	CORRIDOR	-	03	-	36
89.	EXAMINATION SECTION	-	06	-	-
90.	TEQUIP OFFICE	-	04	-	-
91.	DRINKING WATER	-	-	-	08
92.	WASHROOM(HE)	-	-	-	06
93.	WASHROOM(SHE)	-	-	-	06
94.	EXABLISHMENT SECTION	01	-	-	02
95.	OUTSIDE OF PRINCIPLE OFFICE(CORRIDOR)	02	-	-	-
96.	REGISTRAR OFFICE	01	-	-	-
97	DEPUTY REGISTRAR TRAINING	01	-	-	-
98.	TRAINIMG AND PLACEMENT CELL (CORRIDOR)	-	03	-	-
99.	T8PC ROOM	01	01	-	-
LIBRARY					
S.no	Room number	Number of halogens	Number of tube lights	Number of bulbs	Number of CFLs
100.	INSIDE AND OUTSIDE LIBRARY	25	65	-	20
	TOTAL	60	472	-	178

VIII. CALCULATIONS

In this paper, firstly the calculations for the power consumption and total bill paid by institute per month and per year for the light sources such as halogens, tube lights, CFLs is done without replacing the light sources with LED lights.

(1) Total power consumption in one month by halogens:

1 Halogen = 100 watt
Units consumed by 1 halogen in one month = 18 units/month
Cost of one unit = 10 Rs
Total number of halogens= 60
Total units consumed by 60 halogens in one month= 60 x 18=1,080 units/month
1 unit = 1000 watt = 1 kW
Total power consumed by 60 halogens in one month = 1,080 x 1000 = 1080000.00 W = 1080 kW
Total amount paid by institute per month =1080 x 10=Rs 10,800 per month
Total amount paid by institute per year= Rs 1, 29,600.00 per year

(2)Total power consumption in one month by tube light:

1 tube light = 40 watt
Units consumed by 1 tube light in one month = 7.20 units/month
Cost of 1 unit = 10 rupees
Total number of tube lights = 472
Total units consumed by 472 tube lights in one month= 472 x 7.20= 3,398.40 units/ month
1 unit = 1000 watt = 1 kW
Total power consumed by 472 tube lights in one month = 3,398.40 x 1000 = 33, 98,400.00 W = 3,398.40 k W
Total amount paid by institute per month = 3,398.4 x 10 = Rs 33,984 per month
Total amount paid by institute per year= Rs 4, 07,808.00 per year

(3)Total power consumption in one month by CFLs:

1 CFL = 20 watt
Units consumed by 1 CFL in one month = 3.60 units/month
Cost of 1 unit = 10 rupees
Total number of CFL=178
Total units consumed by 178 CFLs in one month= 178 x 3.60=640.80 units/ month
1 unit = 1000 watt = 1 kW
Total power consumed by 178 CFLs in one month = 640.80 x 1000 = 6, 40,800.00 W = 640.80 k W
Total amount paid by institute per month = 640.80 x 10 = Rs 6,408.00 per month
Total amount paid by institute per year= Rs 76,896.00 per year

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Name of Light Source	Total quantity	Total Amount Of Bill In One Month
Halogen	60	10,800.00/-
Tube lights	472	33,984.00/-
CFLs	178	6,408.00/-
Total Amount		51,192/- per month
Total Amount Spent By College Per Year		6,14,304.00/-per year (51,192×12)

Table 2: Showing the total amount of electricity bill spent by institute per month and per year (not replaced by LED lights)

Now, secondly, the calculations for power consumption and total bill paid by institute per month and per year for the light sources such as halogens, tube lights, CFLs is done by replacing the light sources with LED lights.

(1) If 60 halogens are replaced by LED tube lights, than:
1 LED tube light = 18 watt
Units consumed by 1 LED tube light in one month = 18 x 6 x 30 / 1000 = 3.24 units/month
Cost of 1 unit = 10 rupees
Total number of halogens= 60
Total units consumed by 60 halogens in one month= 60 x 3.24= 194.40 units/ month
Total cost = 194.40 x 10 =Rs 1,944.00 per month

TOTAL AMOUNT SPENT BY COLLEGE PER YEAR = Rs 23,328.00
Amount saved by college per year if all 60 halogens will have been replaced by 60 LED tube lights =
Rs 1, 29,600.00 - Rs 23,328.00= Rs 1, 06,272.00 per year

(2) If 472 tube lights are replaced by LED tube lights, than:
1 LED tube light = 18 watt
Units consumed by 1 LED tube light in one month = 18 x 6 x 30 / 1000 = 3.24 units/month
Cost of 1 unit = 10 rupees
Total number of LED tube lights = 472
Total units consumed by 472 tube lights in one month= 472 x 3.24= 1,529.28 units/ month
Total cost = 1,529.28 x 10 =Rs 15,292.80 per month

TOTAL AMOUNT SPENT BY COLLEGE PER YEAR = Rs 1, 83,513.60

Amount saved by college per year if all 472 tube lights will have been replaced by 472 LED tube lights =
Rs 4, 07,808.00 - Rs 1, 83,513.60 = Rs 2, 24,294.40 per year

(3) If 178 CFLs are replaced by LED tube lights, than:
1 LED tube light = 18 watt
Units consumed by 1 LED tube light in one month = 18 x 6 x 30 / 1000 = 3.24 units/month
Cost of 1 unit = 10 rupees
Total number of CFLs=178
Total units consumed by 178 CFLs in one month= 178 x 3.24= 576.72 units/ month
Total cost = 576.72 x 10 =Rs 5,767.20 per month

TOTAL AMOUNT SPENT BY COLLEGE PER YEAR = Rs 69,206.40
Amount saved by college per year if all 178 CFLs will have been replaced by 178 LED tube lights =
Rs 76,896.00 - Rs 69,206.40 = Rs 7,689.60 per year

Hence, if all the tube lights, halogens and CFLs are replaced by LED tube lights of 18 W in higher education institute, than we can save about:

Rs 1, 06,272.00 + Rs 2, 24,294.40 + Rs 7,689.60

= Rs 3, 38,256.00 per year

IX. CLAP SWITCH: A CIRCUIT DESIGNED TO REDUCE POWER CONSUMPTION WITH THE USAGE OF LED BULB

To reduce the power consumption of light in this paper we also designed a project based on clap switch circuit which shows how the energy can be conserved using LED bulb and it can also be helpful to the physically impaired people.

In this project CLAP SWITCH which can switch ON/OFF any electrical circuit by the sound of clap. If we clap the bulb will turn ON and to switch it OFF, clap again. The basic idea of clap switch is that the condenser microphone picks up the sound of your clap. It produces a small electrical signal which is amplified by the succeeding transistor stage. The relay contact is connected to the power line and hence turns ON/OFF any electrical device connected at output socket. The circuit is constructed using basic electronic components like resistors, transistors, relay, transformer, capacitors, and diode. This circuit turns ON light for the first clap. The light turns ON till the next clap. For the next clap, the light turns OFF. The circuit works with 12V voltage. Therefore, a step down transformer 12V/300mA is employed. The working of this circuit is based on amplifying nature of transistor, switching nature of the transistor and relay as a switch. Basically, it is a sound operated switch. It is energy efficient and a reliable circuit. The major advantage is that you can turn ON/OFF something from any location in your room. The primary application involves an elderly or mobility – impaired person. A clap switch is generally used for a light, television, radio or similar electronic device that the person will want to turn on/off from bed. A LED bulb of 3 W is used in this project. But we can use LED bulb of different range (3W-100W) also [12].

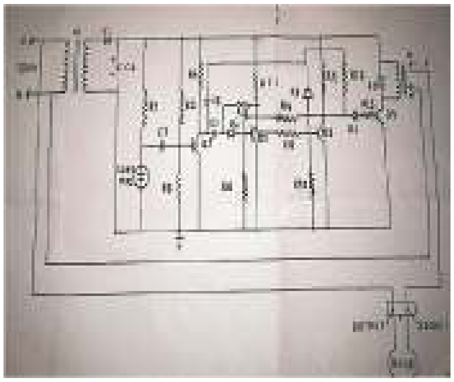

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Fig.7 Basic circuit diagram of clap switch

Fig.8 Basic circuit of clap switch

CALCULATION:
LED bulb = 3W
Total hours of usage = 8 hours (let)
Total Power consumption in one day = 3 W x 8 = 24 W
Total Power consumption in one month = 24 x 30 = 720 W
Total Power consumption in one year = 720 x 12=8640 W
1 unit = 1000 W= 1 kW
Total units consumed by LED bulb in one month = 720/1000= 0.720 units/month
Cost of one unit = Rs. 10
Total bill paid in one month = 0.720 x 10 = Rs 7.20
Total bill paid in one year = Rs 7.20 x 12 = Rs 86.40
In this way the circuit designed by author can perform dual function. It can be helpful to the physically impaired person as they can turn on/off the electrical appliances by the sound of clap only and it also eliminates the use of manpower. On the other hand, as the author has used LED bulb in this project, it helps in reducing power consumption as LED bulbs are more energy efficient and cost effective as compared to CFLs and incandescent bulbs which consumes more power.

X. APPLICATIONS OF LIGHT EMITTING DIODE

1. Narrow band light sensors where LEDs operate in a reverse- bias mode and respond to incident light, instead of emitting light.
2. Large LED displays are used as stadium displays, and dynamic message signs on freeways. Thin, lightweight message displays are used at air ports and railway stations and as destination displays for trains, buses, trams and ferries.
3. Red or yellow LEDs are used in indicator and alphanumeric displays in environments where night vision must be retained: aircraft cockpits, submarine and ship bridges, astronomy observations, and in the field, e.g., night time animal watching and military field use.
4. LEDs are used as street lights and in other architectural lighting. LED light emission may be efficiently controlled by using non imaging optics principles.
5. LEDs are used in aviation lighting. They are also used now in airport and heliport lighting.
6. LEDs are also used as light source for DLP projectors, and to backlight LCD televisions and laptop display.
7. LEDs are used for infrared illumination in night vision uses including security cameras.
8. LEDs are used in mining operations, as cap lamps to provide light for miners. Research has been done to improve LEDs for mining, to reduce glare and to increase illumination, reducing risk of injury to the miners.
9. LEDs are now used commonly in all market areas from commercial to home use: standard lighting, AV, stage, theatrical, architectural, and public installations, and wherever artificial light is used.
10. Lighting white LEDs can be used in systems assisting people to navigate in closed spaces while searching necessary rooms or objects.
11. The light from the LEDS can be modulated very quickly so they are used extensively in optical fibre and free space optics communications. This includes remote controls, such LEDs are often used.
12. LEDs have also been used as medium-quality voltage reference in electronic circuit. The forward voltage drop can be used instead for a Zener diode in low-voltage regulators.
13. Since LEDs can also be used as photo diodes, they can be used for both photo emission and detection. This could be used, for example, in a touch screen that registers reflected light from a finger or stylus.
14. Grow lights use LEDS to increase photosynthesis in plants, and bacteria and viruses can be removed from water and other substances using UV LEDs for sterilization.
15. Opto-isolators use an LED combined with a photodiode or phototransistor to provide a signal path with electrical isolation between two circuits [13].

Fig. 9 Use of LED in traffic light
Source: www.commons.wikimedia.org

XI. CONCLUSION

In this paper, after carrying out survey in higher educational institute of Ajmer, the author(s) has concluded that with the help of LED lighting, more power can be saved and hence the monthly bill of electricity can also be reduced. LED lights are more energy efficient as compared to other lighting sources. If all the tube lights, halogens and CFLs are replaced by LED tube lights of 18 W in higher education institute of Ajmer, than we can save about Rs 3, 38,256.00 per year. In this way, LED lights appear to be beneficial in saving energy and non-renewable sources of energy which are limited. The author(s) has also discussed about various initiatives taken by government of India to promote the usage of LED lighting in the country. The clap circuit designed by the author(s) can prove to be helpful in saving power consumption using LED bulb. The major advantage is that a person can turn ON/OFF something from any location in the room. The primary application involves an elderly or mobility impaired person. A clap switch is generally used for a light, television, radio or similar electronic device that the person wants to turn on/off from bed.

It is possible that in future, this LED technology will open the new door of perception, thinking, vision and opportunities. It is the technology that plays an important role in energy conservation and if the lighting sources such as tube lights, bulbs, halogens are replaced by LED lighting, it is possible that the power consumption can be minimized and non renewable sources can be saved for the future generation.

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Author's Details

Divya Bansal, presently pursuing B.TECH (VII Semester), ECE branch from Govt. Women Engineering College, Ajmer.

Vijay Laxmi Kalyani is currently an Assistant Professor and former HOD in the department of ECE in GWEC, Ajmer. She has attended various workshops, conferences, FDP, STC etc. and also published many research papers in various conference proceedings, International and national Journals. She is a member of IAENG