

# ENERGY AUDIT TO REDUCE LIGHTING COST OF AN INSTITUTIONAL BUILDING

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**Abstract:** An energy audit is a method of inspection the way energy is used and recognizes areas where wastage can be minimized if not total exterminate. It comprises of several tasks which can be carried out depending on the nature of audit and the purpose of the audited facility. The procedure of auditing starts by reviewing the historical data of consumption of energy which can be further collected from the electricity bills. By using these data we are capable to comprehend the forms of energy used and also their trend. After attaining the information based on energy consumption, an energy audit would be our next step. This program will further involve the site survey in order to acquire information on present energy used. An energy audit conducted in this paper indicates some of the opportunities that energy auditor can study after performing an analysis of this institute. An energy audit was conducted in the administrative block of Uttaranchal University and suitable approaches of adjusting and improving energy were recommended so as to decrease the energy requirements and hence the over-all cost spent towards energy consumption.

**IndexTerms-** Energy audit in building, different light loads, collection of data, energy conservation

## I. INTRODUCTION

Energy is the main factor which is responsible for the economic development of a country. Energy should be managed in such a way that we utilize it in a most efficient manner. We need exact information on the number of energy wastages to minimize it. An Energy Audit is a survey, an inspection and an investigation of energy flow for energy conservation or it is a process to decrease the amount of energy input into the system without compromising its utilization. An energy audit is a testing and analysis of how the enterprises and other organizations use energy. There is need of government to improve national energy conservation laws and regulations policy time to time for energy consumption.



Fig1. Image of the Uttaranchal University

## II. GOVERNMENT POLICIES

Indian government plays the major role in energy conservation through making the policies. The energy conservation is focused by the government of India in 9<sup>th</sup> Five-Year plan and an act came into action on 29 Sept 2001 which named an “Energy Conservation Act-2001”. The main features of this act are given as follows:

- Energy management center (EMC) is replaced by Bureau of energy efficiency (BEE).
- Declaration of required energy uses by the designated consumers.
- Providing norms to the industry as specified equipment.
- Introducing energy consumption code.
- Start the energy conservation fund by state and central governments.

### III. ENERGY AUDIT PROCEDURE

An energy audit is a systematic inquiry in which it is found that from where we can reduce the amount of energy from any process or system. The energy audit is categorized into three following categories:

- a. Primary energy audit
- b. Intermediate energy audit
- c. Comprehensive energy audit

A primary energy audit is the screening process which recognizes the wastage of energy in the first look. It includes relevant data collection, brief interview of the persons who are involved in the process, inspection of electricity bills etc. On the basis of these factors, the decisions are made for conservation of energy and it is suggested to the officer in charge of that particular department.

An intermediate energy audit is the extended process of the primary energy audit that needs the detailed information about the particular task. Different energy inputs and their proper utilization are examined by the collection of historical data. Electricity bills are collected for a period of 1 to 2 years by the auditor and estimation of savings are done. Energy equipment is checked for their assigned operation and if needed suggestions are provided for either maintenance or replacement of that particular equipment. Auditor asks a set of questions from the respective personal regarding working of the major equipment.

A comprehensive energy audit is a detailed audit that includes the major changes in the industry or any institution by the suggestion of action plan by the energy auditor. In this audit, the maximum time required is three weeks, in which the comprehensive audit report is prepared. This report combines the audit and suggestion plan for increasing the efficiency of industry or any institutional building.

### IV. COST REDUCTION BY AUDITING

An institutional building is taken into consideration to audit energy because of the fact that an educational building comprised of a large number of workers and also the possibility to conserve the energy will be more. According to the survey, it is estimated that 20% of the total electrical energy consumption is consumed by the lighting load in the building. Thus by replacing these regular tube lights with the CFLs and LEDs can be proved an effective measure. Table 1 shows the cost comparison of different appliances of the administrative building of the University building. Some suggestions are mentioned below:

#### *Recommendations to save energy in admin block of Uttaranchal University*

##### *a. Energy saving by replacing fluorescent lamps to CFLs & LEDs*

###### **(i) FLUORESCENT LAMPS:**

Wattage of existing lamp: 40W

Total number of lamps in admin block: 151 lamps

Usage of 40W fluorescent lamps =  $40W * 151 \text{ lamps} = 6.040 \text{ KWh}$

Assuming 8 working hours in a day and 30 working days per month =  $8 \text{ hrs} * 30 \text{ days} = 240$

Total energy consumption by the fluorescent lamps is:  $6.040 * 8 * 30 = 1449.744 \text{ KWh}$

The cost wise comparison Rs. 6 per unit

Total amount =  $1449.744 * 6 = \text{Rs. } 8,698.464$  per month

###### **(ii) COMPACT FLUORESCENT TUBES (CFLs):**

Wattage of existing lamp: 12 W

Total number of lamps in admin block: 151 lamps

Usage of 12 W CFLs =  $12W * 151 \text{ lamps} = 1.812 \text{ KWh}$

Assuming 8 working hours in a day and 30 working days per month =  $8 \text{ hrs} * 30 \text{ days} = 240$

Total energy consumption by the CFLs is:  $1.812 * 8 * 30 = 434.88 \text{ KWh}$

The cost wise comparison Rs. 6 per unit

Total amount =  $434.88 * 6 = \text{Rs. } 2,609.28$  per month

###### **(iii) LIGHT EMITTING DIODES (LEDs):**

Wattage of existing lamp: 8 W

Total number of lamps in admin block: 151 lamps

Usage of 8 W LEDs =  $8W * 151 \text{ lamps} = 1.208 \text{ KWh}$

Assuming 8 working hours in a day and 30 working days per month =  $8 \text{ hrs} * 30 \text{ days} = 240$

Total energy consumption by the LEDs is:  $1.208 * 8 * 30 = 289.92 \text{ KWh}$

The cost wise comparison Rs. 6 per unit

Total amount =  $289.92 * 6 = \text{Rs. } 1,739.52$  per month

Table1. Cost Comparison of Different Appliances

Details of Light	Fluorescent Lamps	Compact Fluorescent Lights (CFLs)	Light Emitting Diodes (LEDs)
No. of lamps	151	151	151
Watts per lamps	40	12	8
Cost per lamps	Rs 50	Rs 150	Rs 250
Cost of 151 lamps (initial investment)	Rs. 7,550	Rs. 22,650	Rs. 37,750
KWh energy consumed by the lamp	6.040 KWh	1.812 KWh	1.208 KWh
Cost of energy consumed at Rs 6 / KWh	Rs. 36.24	Rs. 10.872	Rs. 7.248
KWh energy consumed per month( assuming 8 working hrs and 30 working days)	1449.744 KWh	434.88 KWh	289.92 KWh
Cost of energy consumed per month	Rs. 8,698.464 per month	Rs 2,609.28 per month	Rs. 1,739.52 per month

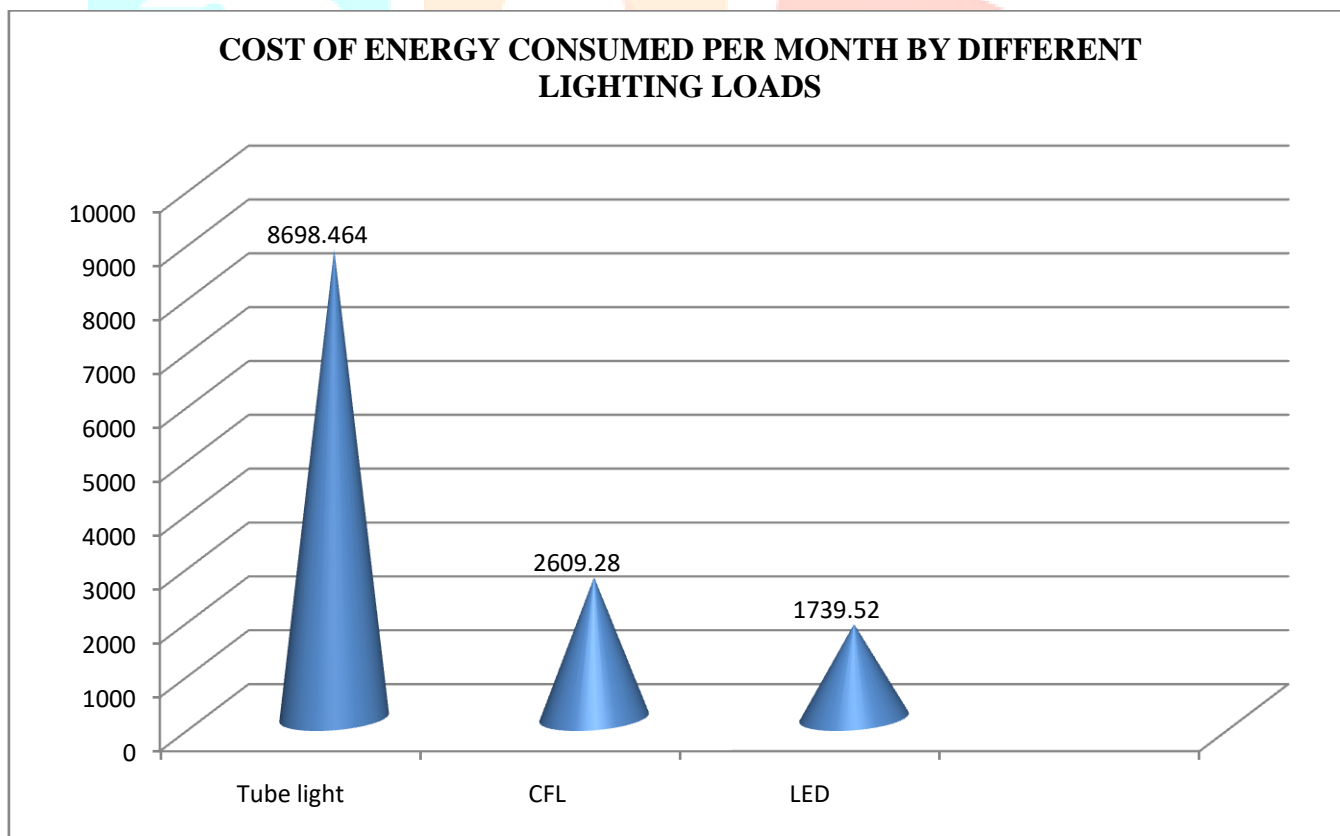


Fig 2: Cost Energy consumption of lighting load

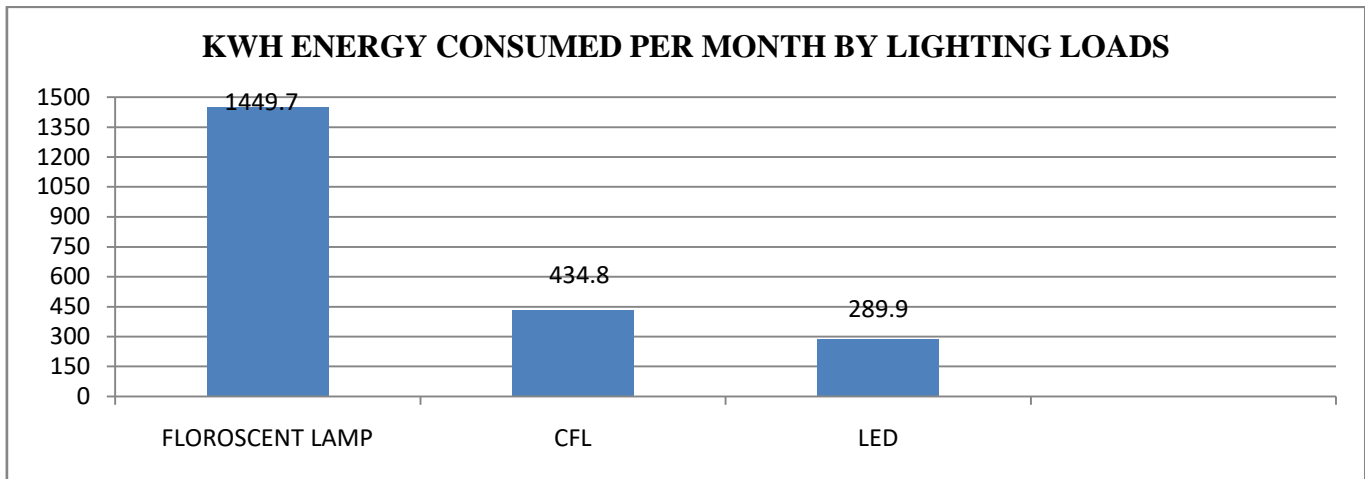


Fig 3:- KWH energy consumption per month by lighting loads

**b. Energy savings by replacing normal fan to energy efficient fan**

**(i) NORMAL FAN**

Wattage of existing fan: 70W  
 Total number of ceiling fans in admin block: 180 fans  
 Usage of 70W fan = 70W \* 180 fans = 12.6 KW  
 Assuming 8 working hours in a day and 30 working days per month = 8hrs \* 30days = 240  
 Total energy consumption by the fans is: 12.6 \* 8 \* 30 = 3,024 KWh  
 The cost wise comparison Rs. 6 per unit  
 Total amount = 3,024 KWh \* 6 = Rs. 18,144 per month

**(ii) ENERGY EFFICIENT FANS:**

Wattage of efficient fan: 60W  
 Total number of ceiling fans in admin block: 180 fans  
 Usage of 60W fan = 60W \* 180 fans = 10.800 KW  
 Assuming 8 working hours in a day and 30 working days per month = 8hrs \* 30days = 240  
 Total energy consumption by the fans is: 10.800 \* 8 \* 30 = 2,592 KWh  
 The cost wise comparison Rs. 6 per unit  
 Total amount = 2,592 KWh \* 6 = Rs. 15,552 per month

Table2. Cost comparison by replacing normal fan with energy efficient fan

Details of Fan	Normal-Fan	Energy Efficient Fan
No. of fans	180	180
Watts per fan	70W	60W
Cost per fan	Rs 850	Rs 1200
Cost of 180 fans (initial investment)	Rs. 1,53,000	Rs. 2,16,000
KWh energy consumed by the light	12.6 KWh	10.800 KWh
Cost of energy consumed at Rs 6 / KWh	Rs. 75.6	Rs. 64.8
KWh energy consumed per month( assuming 8 working hrs and 30 working days)	3,024 KWh	2,592 KWh
Cost of energy consumed per month	Rs. 18,144 per month	Rs 15,552 per month

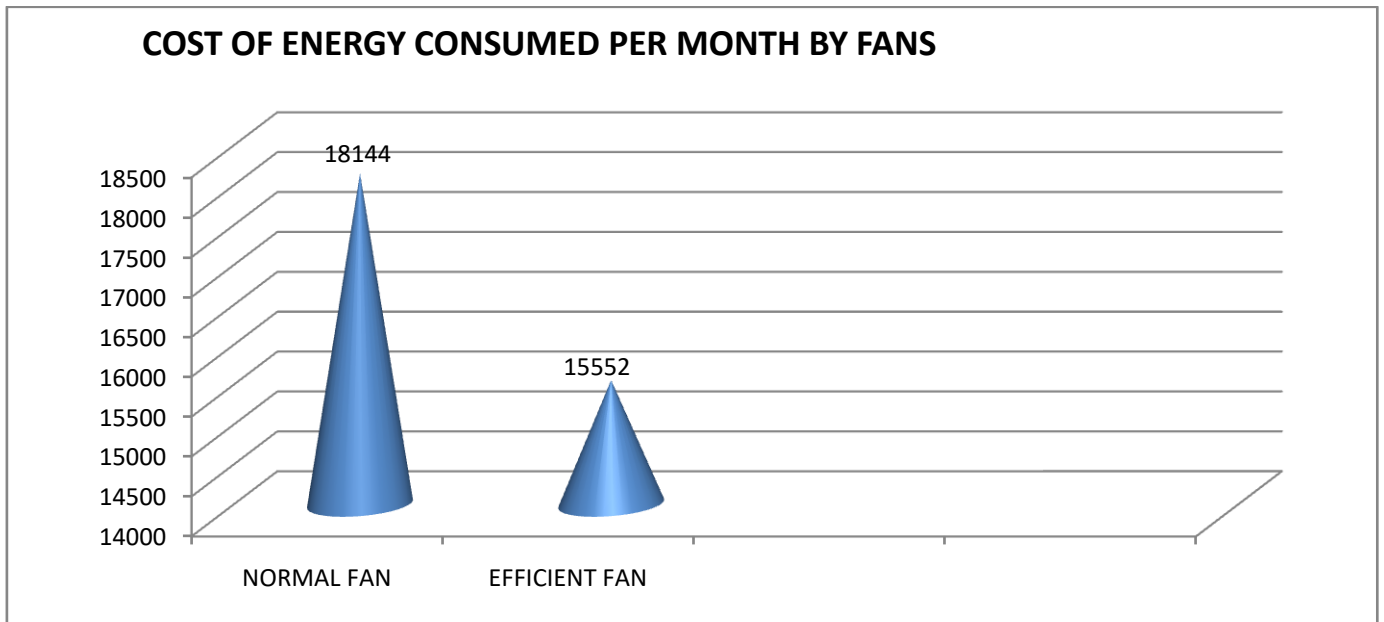


Fig 2: Cost energy consumption by Fans

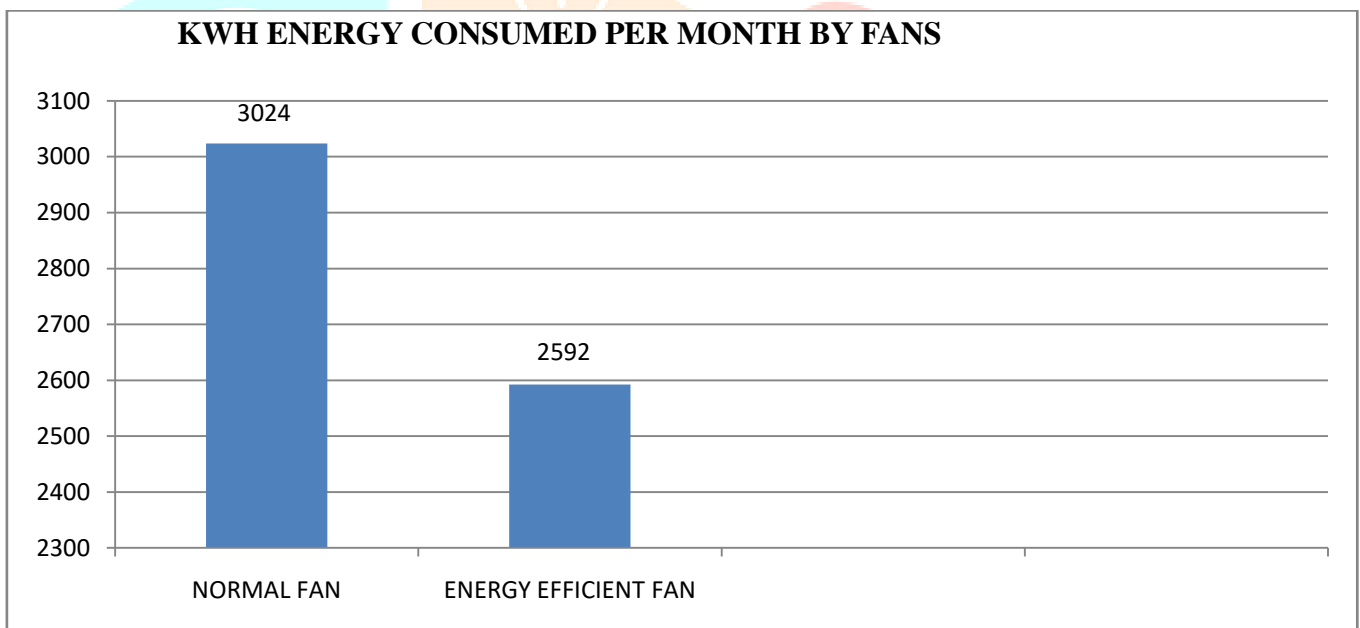


Fig-4:-KHW energy consumption per month by Fans

### V. CONCLUSION

The above-mentioned indications depict that by replacing the Fluorescent lamps with energy saving CFLs (Compact fluorescent lights) or LEDs (Light emitting diode) has reduced the energy consumption from Rs. 8,698.464 per month to Rs. 1,739.52 per month and also Rs. 18,144 per month to Rs 15,552 per month in case of different Fans. Moreover, the carbon emissions produced by these fluorescent lamps will be decreased. Therefore, through this survey, the University can bring down their utility bill amounts to a greater extent. An energy audit is a method that can conserve maximum energy, which in turn further reduce the power requirements in our country. For this, the government may contribute by initiating to use different energy audit policies, which in future can bring a drastic change in the economic sector if India globally.

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