An Effective Approach to Energy Saving and Utilization

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***Abstract*- Due to the rising demand for electricity and the effects that energy use has on the environment, energy conservation is now a crucial issue. This research report offers a thorough analysis of energy conservation strategies', focusing on the habit of turning off lights and other appliances around the house while not in use and also the potential to save energy wastage by street lights. The study uses a case study methodology to gather information from a wide range of places in order to evaluate the effects of adopting energy-saving behaviors. The goal of the study is to estimate the possible energy savings and identify factors affecting the usage and efficiency of these measures of conservation. The study's findings show a link between overall energy use and the adoption of energy-saving procedures, especially turning off lights and other home appliances. Implementing these procedures resulted in considerable energy savings, according to analytical analysis of the data gathered. The research's conclusion points out the need of encouraging energy conservation measures as an effective approach for lowering energy use and its related environmental effects. The study's conclusions give useful details for services, and households, helping in the creation of effective plans and initiatives to promote energy-saving habits at the individual and social levels.**

***Index Terms*- Energy Efficiency, Energy Saving, Energy consumption, Energy Efficiency Measures.**

INTRODUCTION

Electricity is an integral part of the human being in this modern lifestyle. We are completely dependent on uninterrupted power supply to power our gadgets, appliances, healthcare, education, you name it and that requires electricity. The Energy conservation is now at the top of the list of major worldwide problems due to the rising demand for electricity and its effects on the environment. The efficiency of energy-saving techniques is examined in this research work, with a focus on the routine of turning off lights and home appliances when not in use. This study seeks to provide helpful information for service providers, and families to encourage sustainable energy usage by investigating the potential energy savings and factors influencing the use of these measures. The study aims to measure energy savings and uncover important factors that influence people's decision to implement energy-saving behaviors through a case study approach and data gathering from various places.

The global challenge of energy management and energy auditing is not just limited to residential and commercial premises but is also relevant to industrial settings. For example, many large industries are now beginning to seek ways to reduce their energy consumption. This can involve installing efficient machinery, utilizing renewable energy sources such as solar and wind power, and implementing energy-efficient practices in all aspects of production. Additionally, many governments are also introducing incentives and policies to encourage businesses to reduce their energy consumption.

Blackout in India

2 most severe blackouts happened in India on 30th & 31st July, 2012 which affected almost North & East India. Near about 400 million individuals were suffered through power outage on 30th July 2012 & it was more severe than blackout occurred in January 2001 in North India (230 million people were affected)

2. METHODOLOGY

This section provides a brief description of the procedure based on the case study. Energy usage, equipment costs, energy-saving costs, bill of savings, and the are all thoroughly explained and analysed to help you fully understand the concept.

2.1. Energy Auditing and Energy Management

Energy management and energy auditing are becoming increasingly important topics in the global conversation in recent times due to the inevitable increase in energy consumption worldwide. In the past, energy consumption was seen as merely a cost that had to be endured in order to enjoy the convenience of modern life. However, as energy consumption has increased, particularly with the rise of emerging economies, the environmental impact of energy usage has become an issue of ever-increasing importance. As a result, energy management and energy auditing have become essential topics of conversation.

Energy management is the process of monitoring, controlling, and conserving energy at all levels of consumption, from individual households to large industrial companies. This process typically requires the implementation of energy-efficient practices such as implementing automated lighting systems, installing efficient cooling and heating systems, and making responsible choices when it comes to energy supplies. Additionally, it is important to make sure that these efficient systems are properly maintained and regularly serviced.

2.2. Power Consumption

By multiplying the number of equipment's used X, power rating Y, and operation hours H, the electricity consumption of the proposed and current appliances was calculated. Below is the mathematical expression for power consumption:

Power Consumption (unit or KW-H) = X x Y x H/1000

2.3. Power consumption Cost

The cost of consuming power is calculated by multiplying the amount consumed by the price of energy per kilo-Watt-hour.
Power consumption cost = Power Consumption x Price of electricity per unit

2.4. Cost Saved

Bill saving was computed by multiplying energy saving with the electricity tariff. The mathematical expression is given as:

Cost saved = Energy Saving × Electricity price

3. STUDY AREA

3.1. For study purposes, we observed our engineering college. We observed some selective study rooms, tutorial rooms, computer labs, library, laboratory, washrooms as well as canteen. We are able to count and record all the equipment from the rooms. We observed the electrical appliances from the rooms and recorded the data for unnecessary wastage of energy. In our Institute we have installed 8 KW solar power plant for energy generation & wireless solar energy display board is used.

Table 1. Quantity of unnecessarily used electrical equipment in college

No. of Lightning	No. of fans	No. of computers (shutted down but switch was on)
55	31	296

3.2. Analysis of Energy Consumption:

3.2.1Analysis of Energy Consumption By Lights:

In a survey conducted by our team, in our college, we observed that 55 lights were in working mode unnecessarily. On an average if we consider that a light bulb is 20 watt then, the total energy consumed by all the bulbs will be 1100 watt. On a normal working day our college timings are 9:30 am to 4:30 pm, means 7 hours. Therefore the lights are turned on for hours unnecessarily and the energy consumed by them in a day will be approx. 7700 watt-hours which means 7.7 units or KW-H per day only because of lights. If we consider 8 holidays in a month, then the total units in one month will be 169.4 units or KW-H.

3.2.2 Analysis of Energy Consumption By Fans:

In the same survey we found that nearly 31 fans were working unnecessarily. One ceiling fan is rated 70 watt and for 12 hours of usage it consumes 0.84kWh of power. If we consider these fans remain working unnecessarily for 4 hours a day then power consumed by them will be 8680 watt hour means 8.6 units, and in a month total units will be 189.2 units.

3.2.3 Ghost Power: (the power that is lost when the switch is turned on but the load is not connected):

There is some power consumption through the conductors even when the devices are not connected. That is referred to as phantom power or ghost power. These occur when you use the remote control to turn off the TV, audio system, or set the box. Additionally, when you simply turn off a computer without turning off the switch or plug in chargers without connecting them to anything while the switch is turned on.

Many modern electronics fall into this category, and makers even design them to use less power when in standby mode. It's not 0, though. They use a small amount of power. These are used by the standby housekeeping system, which includes circuits for retention, wake-on, ready-to-power-on, and clock operations. Every month, about 5% of the electricity used is used as vampire power, standby power, or phantom load. It implies that failing to turn off the switches while not in use accounts for 5% of the overall electricity bill.

3.2.3.1 Ghost Power Due To CPU:

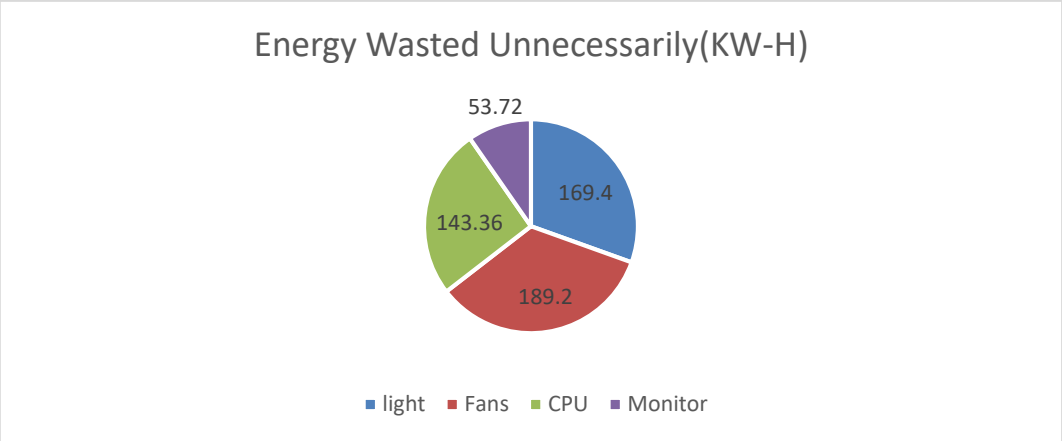
On an average power rating of CPU is 80watt. Generally 5% of the total electricity used by the equipment is due to ghost power. Therefore on CPU takes 4watt due to Ghost Power (non-working mode) . According to Our survey there are 600 computers in our college, among those 296 computers were shutted down but their main switch was turned on. Therefore total power lost by all the CPU will be 1184watts per hour, hence per day consumption will be 6.512 units (considered 5-5.5 hours switch was turned on). Therefore per month power lost will be 143.26 units.

3.2.3.2 Ghost Power Due To Monitors:

On an average power rating of monitor is 30 watts. Generally 5% of the total electricity used by the equipment is due to ghost power. Therefore on monitor takes 1.5 watt due to Ghost Power (non-working mode) . According to Our survey there are 600 computers in our college, among those 296 computers were shutted down but their main switch was turned on. Therefore total power lost by all the monitors will be 444watts per hour, hence per day consumption will be 2.44 units (considered 5-5.5 hours switch was turned on). Therefore per month power lost will be 53.72 units.

Table 2. Power consumption of existing equipments.

S/N	Equipment	Power Rating	Power consumption(per day)(kw-h)	Power Consumption(per month) (KW-H)
1	Lights	20	7.7	169.4
2	Fans	70	8.6	189.2
3	CPU	4(ghost power)	6.512	143.26
4.	Monitor	1.5	2.44	53.72



3.3. Analysis for Energy Saving, Cost of Energy:

Equipment	Consumption
light	169.4
Fans	189.2
CPU	143.36
Monitor	53.72
total	555.68

According to MSEDCL (Maharashtra State Electricity Distribution Company Limited) after 100 units of electricity use they charge 100rs for every 10 units of use. So, cost saved per month will be 55.56×100=5556Rs.

4. Energy Saving:

We can save energy/electricity in two ways: First is we can try to change the bad habits of humans by manually saving energy. The other is we can use technology and make it powerful to reduce power wastage. By using the methods, the needs of energy and the cost of the power can be reduced. The methods for saving electricity/power:-

1. Lights and electrical devices should be turned/switched off when not in operation.
2. Update your lighting with LED's or new saving technologies to save power.
3. Close the drapes and shut the doors in cooler months.
4. Conserve energy when washing and drying garments.
5. Recognise and reduce the energy use in your house/college/office.
6. Smart Lighting- Counter based automated switching system using cameras and motion sensors.
7. Internet connected appliances /IOT.
8. Use Solar energy and utilise it.

5. **CONCLUSION**

The earth's supply of energy is limited. Energy regeneration can also be time-consuming. Thus, conserving energy is unquestionably vital. Most importantly, energy conservation can be accomplished by either using less energy or by using fewer services. We conducted a survey of our college and arranged the data obtained from our college and we have made a case study on the total energy usage and energy wastage. In that, we got an idea about the electricity wastage in our college. So, we studied it and proposed some ways to save the energy & make proper use of the power.

After the whole study, the final conclusion comes out is the energy is infinite but its sources are limited. Hence, we (all humans) should try to save power as much as possible.

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