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Energy Audit: A Case Study of an Engineering Building

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Abstract:- Today, the energy consumption is increased very sharply. This paper is just one step, towards our destination of achieving energy efficiency and we would like to emphasis that an energy audit is a continuous process .In this paper, we discuss about possible actions firstly i.e. How to conserve and efficiently utilize our scarce resources and identified their savings potential; second thing is important to implement on it. In this thesis, an energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options. Energy Saving can be done by improved techniques, better instrumentation and more efficient machinery.

Keywords:- Energy Audit, Energy Consumption, Energy efficiency, Bill, Saving, Payback Period, Measure

INTRODUCTION

- An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings.
- Today, the energy consumption is increased very sharply
- we discuss about possible actions firstly i.e. How to conserve and efficiently utilize our scarce resources and identified their savings potential
- We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential.
- Energy Scenario and energy sources:
- Energy can be classified into various types based on following criteria.
- Primary energy sources are those that are either found or stored in nature. Common primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources available include nuclear energy from radioactive substances, thermal energy stored in earth's interior, and potential energy due to earth's gravity
- Secondary energy sources like steam, electricity are derived from primary energy sources like coal, oil & gases & are suitable for transportation, distribution and control.
- Commercial Energy sources that are available in the market for a definite price are known as commercial sources that are available in the market for a definite price are known as commercial energy. Commercial energy forms the basis of industrial, agricultural, transport and commercial development in the modern world.
- Non-commercial energy sources that are not available in the commercial market for a price are classified as Non-commercial energy. Example: Firewood, agro waste in rural areas; solar energy, animal power, wind energy.
- Renewable energy sources are those that are essentially inexhaustible, like wind power, solar power, geothermal energy, tidal power and hydroelectric power

Non-renewable energy is the conventional fossil fuels such as coal, oil and gas, which are likely to deplete with time

- WORKING LED (Lighting Emitted Diode) is an alternative to traditional light sources and considered to be the latest cutting edge lighting technology. Now a days LED has already exceeded the values of halogen and incandescent lamps.
- Replacing The CRT Monitors With LCD Monitors

Computers with CRT and LCD monitors are nearly equal in number. In total,

- RECOMMENDATION FOR ENERGY SAVING OF TUBE

1. Used natural day light more energy saving
2. Philips 20watt tube should connected in remaining room to more power saving and electricity bill.

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- RECOMMENDATION FOR ENERGY SAVING OF FAN

1. Bajaj 80 watt fan more energy saving than 120 watt fan and more saving electricity bill.

ENERGY CONSERVATION AND EFFICIENCY

1 Energy conservation:
Energy is defined as the ability to do a work and work is transformation of energy from one form to another and also the energy can neither be created nor destroyed. It includes any behavior that results in the use of less energy.
Examples Shut lights off , Don't leave water running, Recycle (bottles, can, papers, glass, etc.) ,Walk or ride a bike ,Open a window in the summer instead of turning on the air conditioning ,use public transportation.

2 Energy efficiency:
It involves the use of technology that requires less energy to perform the same function. A compact fluorescent light bulb that uses less energy to produce the same amount of light as an incandescent light bulb is an example of energy efficiency. The decision to replace an incandescent light bulb with a compact fluorescent is an example of energy conservation. Driving the same amount with a higher mileage vehicle is an example of energy efficiency.

3. Need of Energy Conservation:
Fossil fuels like coal, oil that has taken years to form is on the verge of depleting soon. In last 200 years we have consumed 60% of all resources. For sustainable development we need to adopt energy efficiency measures. Today 85% of primary energy sources come from non-renewable and fossil sources. These reserves increasing consumption and will exist for future generations.

PROBLEM STATEMENT

The total energy consumption of the college for the jully 2018 is Rs 1,80,101 and power consumption for this month is 25047kWh . Through the energy audit it is possible to occurs the above problem. The target is to achieve saving in the electrical energy consumption to the extent of 10% to 20%.

OBJECTIVE

The work eligible for Energy Audit Study should be directed towards:

- Identification of areas of energy wastage and estimation of energy saving potential in Departments and Institute Central Facilities.
- Suggesting cost-effective measures to improve the efficiency of energy use.
- Estimation of implementation costs and payback periods for each recommended action.
- Documenting results & vital information generated through these activities.
- Identification of possible usages of co-generation, renewable sources of energy (say Solar Energy) and
- Recommendations for implementation, wherever possible, with cost benefit analysis.

ENERGY AUDIT METHODOLOGY

The methodology adopted for this audit was a two step process comprising of:

1. Data Collection – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, interviewing key persons, and measurements.

2. Data Analysis - Detailed analysis of data collected was done by manually. The database generated by manually was used for producing graphical representations.

SURVEYING THE ACADEMIC CAMPUS

Survey is the primary stage of energy auditing. Survey means knowledge about the academic area, their building structure, their equipment used in it, how much energy consumed etc. The survey could be divided into three parts:-

1) Preliminary Survey: - Prior to the walk-through survey, the auditor may need to know the building and the way it is used. The information can be obtained from: • Architectural blueprints, • air-conditioning blueprints, • Electrical lighting and power blueprints, • utility bills and operation logs for the year preceding the audit, • air-conditioning manuals and system data, and • building and plant operation schedules extensive in order to identify more ECOs for evaluation, but at an increased need for heavier capital expenditure to realize these opportunities.

2) Walk-Through:- When we familiarized with the building, the walk-through process could be carried out, if the blueprints and other preliminary information available describe the building and its operation accurately. The process could begin with a walk around the building to study the building envelope. If a model analysis is included in the study, the building must be divided into zones of analysis. The survey inside the building would include confirmation that the air-conditioning system is as indicated on plans. Additions and International Journal of Engineering Research and General Science alterations would be noted. The type and condition of the windows, effectiveness of window seals, typical lighting and power requirements, occupancy and space usage are noted. This information could be compared against the recommendations in the relevant Codes of Practices.

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System and plant data could be obtained by a visit to the mechanical rooms and plant room. Name plate data could be compared against those in the building's documents, and spot readings of the current indicating panels for pumps and chillers recorded for estimating the load on the system.

3) Operator's Input

The auditor may discuss with the building maintenance staff further on the operating schedules and seek clarification on any unusual pattern in the trend of the utility bills. Unusual patterns such as sudden increase or decrease in utility bills could be caused by changes in occupancy in the building, or change in use by existing tenants. It is not uncommon for tenants to expand their computing operations that may increase the energy use significantly.

ENERGY CONSUMPTION

SR.NO	DEPARTMENT	POWER CONSUMPTION (KW)	REQUIRED POWER AFTER AUDIT (KW)	POWER SAVING(KW)
1	CIVIL	4429.152	3925.152	504
2	WORKSHOP ELECTRICAL	910.56	856.8	53.76
3	WORKSHOP MECHANICAL	4542.912	4335.024	207.88
4	E&TC	2101.824	1530.624	571.2
5	FIRST YEAR	1139.88	652.648	486.44
6	COMPUTER	3016.864	1806.064	1209.2
7	ELECTRICAL	3168	1979.536	1188
8	SEMINAR HALL	213.264	177.264	36.01
9	LIBRARY	1555.68	904.224	651.416
10	MECHANICAL	4370	3421.04	948.96
11	HOD CABIN&ADMIN OFFICE	2277.52	1598.832	678.688

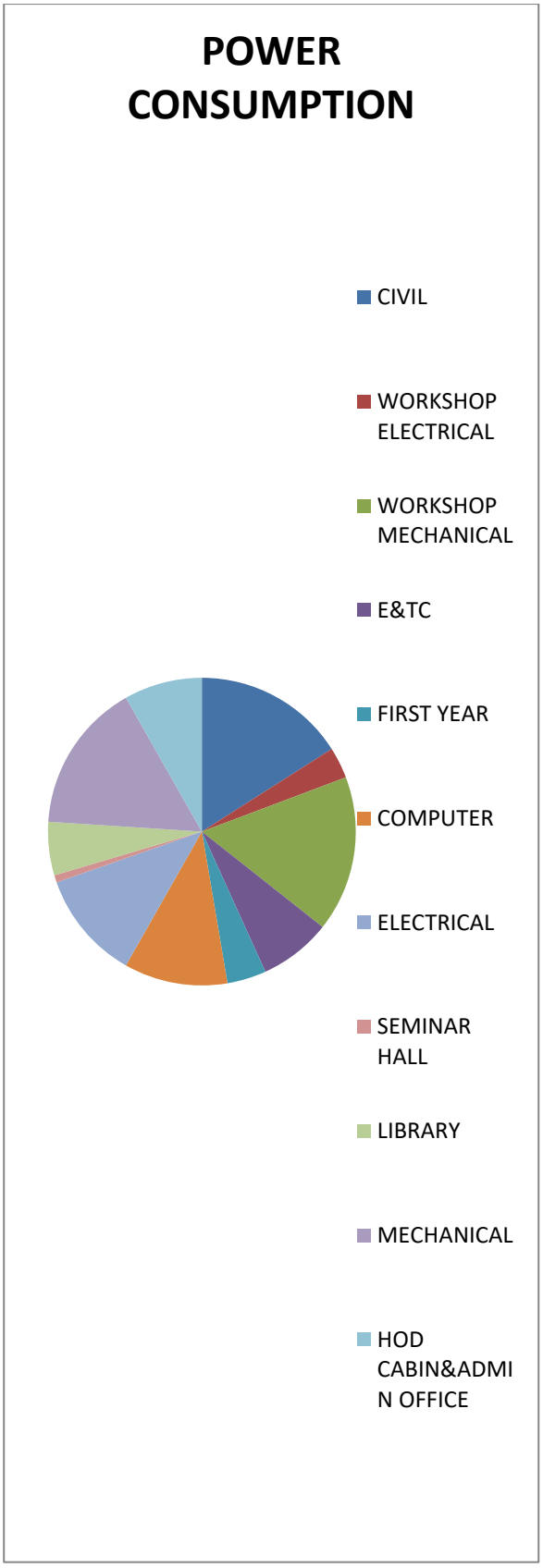

Fig 1.CONNECTED LOAD PIE CHART

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ENERGY SAVING CALCULATION

[1]Replacing The LCD Monitors with LED Monitors Computers with LED and LCD monitors are nearly equal in number.
In total, there are 436 computers LCD monitor. On an average, LCD monitors consume 250W while LCD monitors consume only 150W. This saving of 100W per monitor. But, the LCD monitor is also costlier by Rs. 4000 to 8000. Cost Analysis of Replacing LCD monitors with LED monitors
Total No. of computers with LED monitors in Campus = 436
Power saved per monitor = 100W
Total Power saving = 436*100W = 43600W = 43.6 kW
Average Use of computers per month = 5*24d =120h
Total Energy saved per month =120*43.6 = 5232 kWh
Saving in Rs. per month =5232*8.5 = Rs. 44472
Saving in Rs. per year =44472*10 = Rs. 444720
Average Cost of Replacing each Monitor = Rs5000
Total Cost of Replacing all monitors =436*5000 = Rs. 2180000
Capital Cost Recovery time = (2180000)/ (444720) = 4.90 yrs

[2] Replacing the Tube with Bulb
In total, there is Tube. On an average, Tube consumes 28W while Bulb consumes only 12W. This saving of 16W per Tube. But, the Bulb is also costlier by Rs. 80.
Cost Analysis of Replacing Tube with Bulb
Total No. of Tube Campus = 505
Power saved Tube = 16W
Total Power saving = 505*16W = 8080W = 8.08 kW
Average Use of computers per month = 7*24d =168h
Total Energy saved per month =168*8.08 = 1357.44 kWh
Saving in Rs. per month =1357.44*8.5 = Rs. 11538.24
Average Cost of Replacing each Bulb = Rs80
Total Cost of Replacing all Bulb =505*80 = Rs.40400
Capital Cost Recovery time = (40400) / (11538.24) = 3.5014 months

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Total Energy saved per month =168*8.08 = 1357.44 kWh
Saving in Rs. per month =1357.44*8.5 = Rs. 11538.24
Average Cost of Replacing each Bulb = Rs80
Total Cost of Replacing all Bulb =505*80 = Rs.40400
Capital Cost Recovery time = (40400)/(11538.24) = 3.5014 months

SCOPE OF WORK

In recent years, with the advancement in nanotechnology, it has been become possible to produce suspension of nano particles based suspensions, called nano-fluids. Nano-fluid term was first introduced by Choi in 1995 at the Argonne National Laboratory. The ultrafine nano particles are normally smaller than 100 nm and have remarkably higher thermal conductivity than base liquids. Various Researchers expect that these fluids may offer higher thermal conductivity compared to that of conventional coolants. Major properties of nano-fluids make it suitable to be used in Radiator coolant one already seen is high thermal conductivity, low viscosity, high convective heat transfer coefficient, high area per unit volume.

CONCLUSION

These audits are very important for the society. The buildings, offices, rooms etc. are designed without taking into consideration of the use of energy efficient lighting system. These buildings consume more energy as the energy required by energy efficient structure design for In this we have considered the academic sector for evaluation of energy audit and energy conservation of s.b.patil college of engineering Vangali ,Indapur. Key issues pertaining to the implementation of Energy Conservation proposal and methodology have been discussed in detail. Based on the exhaustive literature survey were presented for energy conservation and energy audit in keeping mind the present Energy scenario and future condition

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