Opportunity of Energy Saving: A Case Study of Engineering College Workshop

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Today energy is a prime focus due to rapid growth and development of technology. Energy audit is going to play a vital role in order to save energy and make the process efficient. Energy efficiency is extremely important to all the organization. It should not be limited industry; creating awareness in all users of energy is an urgent task. Although industry is a major user of energy we can not overlook the energy consumption in other sector. This paper includes the case study of engineering college's workshop. It is found that both energy and time can be saved using suitable method & tips and earliest opportunity to create awareness of energy conservation among the students.

Keywords: Energy audit.

1. INTRODUCTION

Energy is an essential building block of economic development. Energy conservation which once was considered as an option to increase the profitability has become a necessity now to offer equal level playing field with the global competitors and stay on the race. India is facing crisis due to acute Shortage of Electrical Energy and ever growing demand. Bulk of the Electricity is consumed by Industrial sector followed by Agriculture, domestic and commercial applications. More than 70% of the electricity is consumed by electric motors in organizations. Even a 5% saving in electricity will prevent the need to install power plants of a few thousand MW. Energy conservation has now become a necessity with Government of India formulating mandatory Energy Audit and Energy conservation regulations. Considerable energy saving is possible through proper choice of equipment, and their effective use. Data of energy consumption pattern through Energy Audit for any given application essential to evolve conservation measures [1].

2. ENERGY CONSERVATION

Energy conservation is the practice of decreasing the quantity of energy used. It means reduction in energy consumption but without making any sacrifice of quantity and quality of production. In other words, for the same energy consumption, higher production. It may be achieved through efficient energy use, in which case energy use is decreased

while achieving a similar outcome, or by reduced consumption of energy services It does not prevent you, use of energy of fixing some limit quantitatively within the agreement but insists for use efficiently thus decreasing the cost of production to some extent by way of reduction of energy. Thus energy saved is the money earned which would be used in other means. It is therefore imperative that electricity which is in shortage be utilized efficiently and the areas of where the energy is wastefully used are to be identified and corrective measures are searched for adoption [2].

3. ENERGY AUDIT

An energy audit is an inspection, survey and analysis of energy flows in a building, process or system with the objective of understanding the energy dynamics of the system under study. Typically an energy audit is conducted to seek opportunities to reduce the amount of energy input into the system without negatively affecting the output. An Energy Audit Study helps an organization to understand and analyze its energy utilization and to identify areas where energy use can be reduced, to budget energy use, plan and implement feasible energy conservation measures that will enhance their energy efficiency, curtail energy wastage and substantially reduce energy costs.

It serves to identify all the energy streams in a facility, qualify energy usage with its discrete functions, in an attempt to balance the total energy input with its use. Energy Audit is thus the key to a systematic approach for decision-making in the area of Energy Management.

Energy Audit translates conservation ideas into actual money saved. It blends technically feasible solutions with economic and other organizational considerations within a specified time frame. It is more beneficial than a piecemeal introduction of short-term measures, as it is a comprehensive strategy that also envisages gearing up of organizational structure and other infrastructure requirements [3].

3.1. Benefits of Energy Audits

- Significantly lower electrical, natural gas, steam, water and sewer costs.
- Address indoor air quality, lighting quality and building occupant satisfaction.
- Reduce greenhouse gas emissions, and air pollution.

4. ENERGY AUDIT STUDY INCLUDES

- Auditing of Energy Consumption (including any heat and power generated).
- General examination of work place (including physical condition of organization, its processes, occupancy time, and variations in ambient temperature and energy consumption pattern etc.).
- Measurement of all energy flows.
- Analysis and appraisal of energy usage.(e.g. specific fuel consumption, energy-

-product interrelationship).

- Energy management procedures and methodology.
- Identification of energy improvement opportunities and recommendations for energy efficiency measures and quantification of implementation costs and paybacks.
- Identification of possible usages of renewable sources of energy and recommendations for implementation, wherever possible, with cost benefit analysis.

5. METHODOLOGY

5.1. Preliminary Energy Audit

The Preliminary audit will be performed to focus on major energy supplies and demands of the industry. The scope of this audit is to highlight energy costs and to identify wastages in major equipment processes. It sets priorities for optimizing energy consumption.

5.2. Detailed Energy Audit

This covers estimation of energy input for different processes, losses, collection of past data on production levels and specific energy consumption. It is a comprehensive energy audit action plan to be followed effectively by the industry. The scope of this audit is to formulate a detailed plan on the basis of quantitative and control evaluation, to evolve detailed engineering for options to reduce total energy costs, consumption for the product manufactured. The detailed audit goes beyond quantitative estimates of costs and savings. It includes engineering recommendations. Approximately 95% of all energy is accounted for during the detailed audit [1,4].

6. CASE STUDY OF WORKSHOP

6.1. Sawing

Sawing is a process in which a narrow slit is cut into the work by a tool consisting of series of narrowing spaced teeth. Sawing is normally used to separate a work part into two pieces or to cut off an unwanted portion of a part. These operations are often referred to as cutoff operation. These operations can be divided into two categories

(a) Reciprocating sawing
(b) Circular sawing

Now these days, in engineering colleges these machines are used to cut the metal as well as wooden pieces.

6.2. Survey of the Sawing Machines

In Jaipur, there are 30 engineering colleges. Among them fives are randomly selected and took the data's which are follows

S. No.	Institute	Reciprocating saw	Circular saw
1.	A	✓	X
2.	B	✓	X
3.	C	✓	X
4.	D	✓	X
5.	E	✓	✓

6.3. Cost of Sawing Machines

S.No.	Type of Sawing Machine	Cost
1.	Reciprocating	Rs10000/-
2.	Circular	Rs9000/-

6.4. Comparative Study of Wood Cutting Between the Two

6.4.1. Study of Reciprocating Saw

This machine is used for cutting off operation with the help of this operation desired length of stock is cut. This machine carries a reciprocating frame which consists of a cutting blade. The blade moves forward and backward with the frame and cutting takes place in one direction only. It is used for cutting both wood and metal.

(a) Analysis of Wood Cutting

S. No.	Type of wood	Chid
1.	Length	14 cm
2.	Breadth	7 cm
3.	Height	7 cm
4.	No of wooden pieces to be cut	300 (Say)

(b) Motor Specifications

S. No.	Particulars	Rating
1.	H.P.	1
2.	PH	3
3.	RPM	1440
4.	Kw	0.75
5.	Amp	1.5
6.	V	415

Average time taken to cut the wood=20min=20/60 hrs

Power consumed by 1 HP motor to cut one piece= (20/60) X746=248.66 watt

Power consumed by 1 HP motor to cut 300 piece= (248.66X 300) = 74598 watt

=74.598 kWh

=74.598 units of electricity

6.4.2. Study of Circular saw

It uses a rotating saw blade to provide a continuous motion of the tool past the work. Circular sawing is often used to cut long bars, tubes, and similar shapes to specified length. These machines have powered spindle to rotate saw blade and a feeding mechanism to drive the rotating blade in to the work.

(a) Analysis of Wood Cutting

S. No.	Type of wood	Chid
1.	Length	14 cm
2.	Breadth	7 cm
3.	Height	7 cm
4.	No of wooden pieces to be cut	300 (Say)

(b) Motor Specifications: Same as above case

Average time taken to cut the wood=5 sec=5/3600 hrs

Power consumed by 1 HP motor to cut one piece= (5/3600) X 1 X 746= 1.036watt

Power consumed by 1 HP motor to cut 300 piece=300X1.036=310.08 watt

=0.301 kWh

=0.301 units of electricity

Energy saved by circular saw to the cut the same wood = 74.598-0.310=74.288 units of electricity

6.5. Questionnaires

S. No.	Questions	A	B	C	D	E
1.	Is there proper ventilation in workshop?	✓	x	x	✓	✓
2.	Is there separate switch to on and off for each item?	✓	✓	✓	x	x
3.	Are evergreen trees and shrubs are planted around the workshop?	x	x	x	x	✓
4.	Are fewer windows on the north side of the workshop	x	✓	✓	x	x
5.	Is light always switch off when machine is not operating?	x	x	x	✓	✓
6.	Are lighting means required in day hours?	x	✓	✓	x	x
7.	Are machines run on full speed? (Reduction in speed by gear or pulleys unnecessarily)	x	x	✓	✓	✓
8.	Are machines properly maintained or oiled properly? time to time	x	✓	x	✓	x
9.	Are there energy policy or energy awareness program in college?	x	x	x	x	x
10.	Are energy effectively used in workshop?	x	x	x	x	x
11.	Are workshop has tin shed or not?	✓	x	x	✓	✓

6.6. Finding and Suggestions

(i) It is found that circular saw is more suitable than reciprocating one so it's better to install the circular saw. It is noted down that large no. units of energy can be saved by circular saw.

(ii) During the audit, it is found that in some colleges there are no trees or shrubs around the workshop and no proper ventilation. This can cause the excessive use of electricity by ceiling or wall fans and exhaust fan

(iii) Lighting means are not effectively used. It is required to switch off the light above the machine when it is not working.

(iv) During the survey, it is found that some machines have unnecessarily engaged the gear or pulleys. So can cause the slow operation and consume the more electricity. Use the full speed of spindle unless it is not restricted by the process.

(v) During the audit, it was found that some electrical appliances use the same switch to on & off. It is undesirable, avoid it.

(vi) Excessive heat is found in the workshop during the summer so it is required to have a window on north wall instead of south wall.

(vii) It is recommended to implementing the renewable sources of energy.

7. CONCLUSION

It is evident from the case studies that there is potential for energy savings by adopting to suitable energy conservation measures. There is a huge area still remaining unexplored and there is a vast potential for energy conservation. A huge amount of money or profit can be booked by employing the energy conservation and energy audit. Energy saving is an energy generated so that lot of problem regarding to the energy deficiency can be solved [5].

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