

Energy Audit – A Case Study

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Abstract- In this review paper we are simply going to review some research papers related to the case study of energy audit of different different locations. Worldwide reports appear around 25 to 35% vitality sparing potential in business structures. Numerous structures in India, arranged in various climatic zones are vitality wasteful since they were not developed following vitality protection construction standards and systems of sunlight based uninvolved design. It is unfeasible to upgrade and remake such structures.

In such cases retrofitting of utilities gives a savvy arrangement than going for adjusting the current building structures. The point of this paper is to introduce the outcomes produced from an itemized vitality review examine led in an office structures to spread the consciousness of vitality sparing possibilities in Indian structures. In light of information gathering also, estimation embraced, the present contextual analysis imagines numerous vitality sparing measures to be considered for execution towards accomplishing the vitality sparing potential in the recognized zones. The recognized zones were Aerating and cooling, Lighting, UPSs, Power factor change and establishment of Energy Management Framework (EMS). The examination uncovered that people in general office working in which the definite vitality review was completed has the yearly vitality sparing capability of 231656 kWh, in terms of cost sparing; it would be Rs. 16.2 Lakhs.

All together to accomplish this advantage, it requires one time venture of Rs. 27.5 Lakhs, coming about the payback time of 1.7 years. It is an essential procedure to be completed for vitality preservation. In vitality preservation, the push is given on the sparing of vitality while completing the required work.

Keywords- Audit, collection of data, implementation

I. INTRODUCTION

The developing vitality request and supply hole is one of the purposes behind climb in cost of petroleum products. The expanding utilization of non-renewable energy sources has caused air contamination prompting an Earth-wide temperature boost.

These wellsprings of vitality are not replenishable and hence the center is moving towards vitality protection and utilization of sustainable power source. It is evaluated that around half of worldwide vitality utilization is because of structures [1]. Vitality utilization in structures shifts as per atmosphere, geology, building write and area. The distinction between created and creating nations is likewise essential in this setting [2]. India positions fifth as a worldwide vitality shopper [3]. By 2035, India will progress toward becoming import-subordinate.

India's vitality creation would increment by 112%, while utilization would ascend by 132% [4]. Indian government has started numerous approaches and administrative measures to guarantee vitality security however an extensive number of issues still remain and they require noteworthy consideration. Joining of vitality proficiency measures in existing and new structures will push India to accomplish a solid vitality future [5].

Vitality Audit can be ordered into I) Preliminary Audit ii) Detailed Audit. Preparatory vitality review is generally fast exercise, it gauges the degree for sparing utilizing the current or effectively got information and distinguishes the territories for more point by point think about. The itemized vitality review is completed in three stages: Phase I - Pre Audit Stage, Phase II - Audit Phase, Phase III - Post Audit Phase. This is an exhaustive review which offers the most precise gauge of vitality funds and cost [6]. In this present investigation, the procedure utilized for point by point vitality review was embraced. This paper features vitality sparing possibilities and practicality of accomplishing the same in the current open office working in India.

II. VITAL POINTS TO CONSIDER WHEN COLLECTING SITE LOAD DATA

Vital Points To Consider When Collecting Site Load Data

- Working hours: It is gathered from plant personnel. This information should be exact to gauge vitality funds accurately.
- Obligation Cycle: Machines, for example, huge acceptance engines have changing burdens with

various power requirements. Hence obligation cycle is imperative

- **Genuine Power Consumed:** For electric power clients, this depends on either 3-stage current/voltage readings or power analyzer measurements (e.g. coordinate KW which joins control factor). For fuel clients, tank readings of month to month utilization gauges furthermore, stream meters with totalization can be wellspring of estimation.

Activity Plan To Set Implementation Priority

Subsequent to breezing through the money saving advantage examination test, an activity design ought to be produced to guarantee that the openings distinguished are implemented. The activity design ought to incorporate all the significant strides for executing the open door and in addition the general population mindful. Besides, there ought to be an arrangement to screen the outcomes.

Types of Energy Audit

The term Energy Audit tries to distinguish the elective vitality effective measures that would likewise satisfy the budgetary criteria of the speculators. A defiled determination of the extension of work: is important to speed out the necessity of the review. There are three normal review programs which are portrayed in next pages.

Preliminary Audit

The preparatory review additionally called as a basic review, screening review "01" stroll: through review, is the most straightforward and snappier write of audits. It includes negligible meetings with the site working personnel. A brief audit of the facility service bills what's more, other working information, and a stroll through of the office to get comfortable with the plant activity and distinguish zones of vitality waste or wastefulness. Major issue regions will be revealed amid this sort of audit. Corrective measures are quickly portrayed and gauges of usage costs, potential working cost funds, and basic pay back periods are provided. This serves to prioritize vitality proficient undertaking and determine the requirement for a more nitty gritty review.

General Audit

General review or a smaller than expected review/site vitality at it develops the preparatory audit. More point by point data about office task is gathered in order to play out a more point by point assessment of vitality preservation

measures distinguished. Service bills for a time of 12 to three years are collected to assess the facility's vitality/request rate structures and vitality wage profiles. Additional metering of particular vitality expending frameworks is frequently performed to supplement utility data. In-proficiency interviews with office working faculty are directed to comprehend major vitality expending frameworks and also knowledge into varieties in day by day and yearly vitality utilization and request. A point by point money related examination is performed for every measure to legitimize venture usage.

Phases of Energy Audit –

There are basic three phases of analyzing the energy audit of three phase circuit :

Phase 1 – Pre- Audit

Phase 2- Audit

Phase 3 – Post Audit

III. METHODOLOGY

Energy audit involves the following methodology -

1) Statistical Data Collection-

Right now the accumulation of information for the framework is finished by a group of understudies who review the utilization of power in a house physically. Accumulation of information includes the following advances.

- a) Preparation of Power Distribution Single Line Diagram - Collect all the heap points of interest for electrical gear with high power utilization and figure the use stack after single line outline has been bolstered with stack esteems.
- b) Real time deposit bend - Plot continuous stack bend by taking the vitality meter KWHR, for 20 days.
- c) Real time control misfortune - Identify and compute the superfluous use what's more, control wastage in the format with diagram.
- d) Equipment Life Cycle Analysis - Information accumulation of all the major hardware and discover their individual execution.

2) Electrical usage Investigation –

A review will be directed for getting the information to mine particular examples in the electrical utilization.

a) Interview with employees - Meeting with employees to comprehend the patterns in electrical utilization.

b) Study the Status of Earthing - Check the earth protection and give an account of the status of earthing in that worry.

3) Statical Data Calculation –

Computation of these information is a troublesome assignment. We expect to get mechanization in the procedure of computation.

a) Load computation of single line chart - Calculate the associated stack regarding single line chart.

b) Energy Meter Tariff Graph - Plot a chart amongst years and levy.

c) Power use diagram - Draw the control use diagram with deference to the format.

4) Statical Data Analysis –

Investigation includes examining the information for particular utilization designs. The accompanying advance is engaged with the measurable information examination.

a) Energy preservation opportunity - Recognize the vitality preservation openings.

5) Recommendation –

Once the information is investigated reasonable proposals are given to the clients. Following advances are associated with the procedure of proposal.

a) Recommendation – Provide a report on reasonable proposal for existing apparatuses and proposals for usage of vitality moderate measures.

b) Cost benefits - Plot money saving advantage investigation with breakeven diagram.

c) Awareness on Electrical Safety - Give mindfulness on electrical security to the concerned clients.

IV. ENERGY CONSUMPTION

Number of hours load are connected on an average in campus and corresponding energy consumption (Based on daily observations)

Lighting load:

Lights:

Total number of lights in all class rooms from floor 1 to floor 5 is 678 which on an average are switched on for 5hrs/day.

Total energy consumption of lights in all class rooms in a month = $(678 \times 36 \times 5 \times 24) = 2928.96 \text{ kWh}$

Total number of lights in library is 72 which on an average switched on for 10hrs/day.

Total energy consumption of lights in library = $(72 \times 36 \times 10 \times 24) = 622.08 \text{ kWh}$

Total numbers of lights in all labs in all floors are 163 which on an average are switched on for 6hrs/day.

Total energy consumption of lights in all labs = $(163 \times 36 \times 6 \times 24) = 844.992 \text{ kWh}$

Total numbers of lights in both staff rooms in floor 3 and floor 6 are 144 which on an average switched on for 10hrs/day.

Total energy consumption of lights in both staff rooms = $(144 \times 36 \times 10 \times 26) = 1347.84 \text{ kWh}$

Total number of lights in ground floor which on an average switched on for 8hrs/day is 50.

Total energy consumption by these lights = $(50 \times 36 \times 8 \times 26) = 374.4 \text{ kWh}$

(Note: Number of working days in a month is taken as 24)

Fans:

Total number of fans in the campus is 650 (by count) which are on an average switched on for 7hrs/day.

Total energy consumption by all fans in campus in a month = $(650 \times 75 \times 7 \times 25) = 8531.25 \text{ kWh}$

Total energy consumption by lighting load = $(2928.96 + 622.08 + 844.992 + 1347.84 + 374.4 + 8531.25) = 14649.522 \text{ kWh}$

Total computer load connected in campus is $(11820 + 1800 + 112 + 168 + 150 + 800) = 14.85 \text{ kW}$ which on an average is switched on for 6hrs/day (based on the schedule of the labs).

The total energy consumption by computers in the campus in a month = $(14.85*6*24) = 2138.4\text{kWh}$

There are total of 400 computers along with CPU and each CPU consumes 40w

The total energy consumption of CPUs in a month = $(400*40*6*24) = 2304\text{kWh}$

Total AC load in all labs is $(45.2+5.6) = 50.8\text{kw}$ which on an average switched on for 6hrs/day.

Total energy consumption by AC units in labs = $(50.8*6*24) = 7315.2\text{kWh}$

AC load connected in auditorium is 44.16kw which on an average is switched on 30hrs/month

Total energy consumed by AC load in auditorium = $(44.16*30) = 1324.8\text{kWh}$

The rest of all minor loads including water coolers, AC units in VC and Director Cabin, Refrigerator and some missing load because of human counting errors are considered to be 1000kWh.

The total energy consumption for one month = $(14649.522+2138.4+2304+7315.2+1324.8+1000) = 28731.922\text{kWh}$

V. ENERGY CONSERVATION

Lights:

A T8 lamp generally produce 2700 lumens rated at 36 watts but a T5 lamp produce the same amount of lumens at 28watts [7].

Replacing all existing T8 with 28w T5 then
 Classes – $(678*28*5*24) = 2278.08\text{kWh}$
 Library – $(72*28*10*24) = 483.84\text{kWh}$
 Labs - $(163*28*6*24) = 657.216\text{kWh}$
 Staff room – $(144*28*10*26) = 1048.32\text{kWh}$
 Ground floor – $(50*28*8*26) = 291.2\text{kWh}$
 Total = 4758.656kWh/month
 $(4758.656*12 = 57103.872\text{kWh/year})$

Total energy consumption for lights by T8 lamps = 6118.272kWh/month
 $(6118.272*12 = 73419.264\text{kWh/year})$

Total energy saved by using T5 lamps = $(73419.264-57103.872) = 16315.392\text{kWh/year}$

The average tariff cost for the year 2014 paid by our collage is 9.995Rs/kWh

Total amount saved by sing T5 lamp per year = $(16315.392*9.995) = 163072.343\text{Rs/kWh}$

Replacement of each T8 lamp with T5 costs 500Rs

Replacement of 1107 T8 with T5 costs = $(1107*500) = 553500\text{Rs}$

Payback period by replacing T5 with T8 = $553500/163072.343 = 3.394\text{years}$

VI. CONCLUSION

It's an alert to the general population all around the world on the emergency of vitality. There may exist elective wellsprings of vitality however there doesn't exist an overflow request to address the issue of the considerable number of individuals. The existing vitality must be rationed. The above procedure lessens the vitality utilization around 20-30%. However the real proposal for the vitality protection is monitoring the emergency and sparing it for future.

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