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Energy Audit and Electrical Power Consumption of ADIT College

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Abstract -*Energy audit will help us to understand more about the ways energy is used in industries, administration and commercial building and it will also help us to identify the areas where waste can occurs and where scope for improvement exist. It will also help us to keep focus on variation which occur in energy cost, identify energy conservation technology In general energy audit is translation of conservation ideas into relatives, by leading technically feasible solution with economy and other organizational consideration with in a specific time frame. So it is the way by which we can calculate total energy consumption of an organization and we can also find various methods to reduce the total energy consumption. The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmer which are vital for production and utility activities. Such an audit programmer will help to keep focus on variations which occurs in the energy costs, availability and reliability of supply of energy, decide on appropriates energy mix and identify energy conservation technologies.*

Key Words: **Energy saving, Energy Efficiency, Renewable Energy, Minimal waste of Energy, Anticipation or Forecast analysis.**

1. INTRODUCTION

An energy audit, sometimes referred to as an energy survey or an energy inventory, is an examination of the total energy used in a particular property. The analysis is designed to provide a relatively quick and simple method of determining not only how much energy is being consumed but where and when. The energy audit will identify deficiencies in operating procedures and in physical facilities. Once these deficiencies have been identified, it will be apparent where to concentrate efforts in order to save energy. The energy audit is the beginning of and the basis for an effective energy-management program.

The chapters that follow explain the procedures and computations necessary to understand all phases of energy consumption. The data compiled will be suitable for use in both manual and computer-assisted energy audits.

2. CONDUCTION THE ENERGY AUDIT

In order to audit energy consumption, several steps are necessary. The basic procedures to be followed are:

A) The historical audit summarizes all types and amounts of energy used in the past. Data should be compiled and analyzed on the totals of both energy consumption and costs. This analysis, then, becomes the base with which future energy use will be compared.

B) The diagnostic audit is carried out to identify the users of energy and to discover any deficiencies in operating and maintenance procedures as well as in physical facilities. This part of the audit is usually done in two parts: an equipment survey and a building survey.

C) The financial evaluation determines the most cost-effective options. This will lead to the establishment of high-priority actions to be undertaken in the energy-management programme.

Each of these steps is explained in detail in the following pages, where appropriate, to assist in recording the necessary data. Once the energy audit has been completed, there will be sufficient information upon which to establish an energy-management programme. However, the existing situation should be fully understood before any attempt is made at improvements.

3. TYPES OF ENERGY AUDITS

The energy audit orientation would provide positive results in reduction energy billing for which suitable preventive and cost effective maintenance and quality control programmers are essential leading to enhanced production and economic utility activities. The type of energy audit to be performed depends upon the function or type of industry. There can be three types of energy audit.

- Preliminary energy audit
- General energy audit
- Detailed energy audit

3.1 Preliminary Energy Audit

The preliminary energy audit alternatively called a simple audit screening audit or walk through audit, is the simplest and quickest type of audit. It is carried out in a limited span of times and it focuses on major energy supplies and demands. It aims at taking steps which are necessary for implementation of energy conservation program in an establishment. It involves activities related to collection, classification, presentation and analysis of available data in

arising at the most appropriate steps to be taken in establishing energy conservation. It involves collection of necessary data, minimal interviews with site operating personnel, a brief review of facility utility bills and other operating data and identifies glaring areas of energy waste or inefficiency.

Typically, only major problems area will be uncovered during this type of audit, corrective measures are briefly described and quick estimates of implementation cost, potential operating cost savings and simple payback periods are provided. This level of detail, while not sufficient for searching a final decision on implementing proposed measures, is adequate to prioritize energy efficiency projects and determine the need for more detailed audit.

3.2 General Energy Audit

The general energy audit is also called a mini audit or site energy audit or complete site energy audit. It expands on the preliminary audit by collecting more detailed information about facility operation and performing a more detailed evaluation of energy conservation measures identified. Utility bills are collected for a 12 to 36 months period to allow the auditor to evaluate the facility energy/demand rate structure and energy usage profiles. Additional metering of specific energy consuming systems is often performed to supplement utility data. In depth interviews with facility operating personnel are conducted to provide a better understanding of major energy consuming systems as well as insight into variations in daily and annual energy consumption and demand. This type of audit will be able to identify all energy conservation measures appropriate for the facility given its operating parameters. A detailed financial analysis is performed for each measures based on detailed implementation cost estimates, site specific operating cost savings and the customer's investment criteria. Sufficient detail is provided to justify project implementation.

3.3 Detailed Energy Audit

Detailed energy audit is also called comprehensive audit or investment grader audit. It expands on the general energy audit. It covers estimation of energy input for different processes, 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. It provides a dynamic model of energy use characteristics of both the existing facility and all energy conservation measures identified. The building model is calibrated against actual utility data to provide a realistic baseline against which to compute operating savings for proposed measures.

Extensive attention is given to understanding not only the operating characteristics of all energy consuming systems, but also situations that cause load profile variations on both an annual and daily basis. Existing utility data is supplemented with sub metering of major energy consuming systems and monitoring of system operating characteristics.

Thus, 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. It should be at 8 to 10 percent savings, detailed audit study shall be completed in a period of three weeks from the date of commencement. After which, preparation of energy audit reports shall be completed in a period of three weeks. The major system that are encountered in industries with regard to which energy audit is to be carried out are: Boilers, furnaces, air conditioning systems, refrigeration or cold room etc., power generation and distribution systems, compressed air generation systems, pumping systems and electric motor driven systems.

4. ENERGY SAVING ON LIGHTING SYSTEMS

Lighting energy consumption of the whole factory is limited to the 17 00 of the total electrical energy consumption. During the factory audit several places are identified as the places where the savings are easily guaranteed. A count on lighting is needed to be done, after identifying the proper locations. As a rule of thumb, the followings are the common methods of energy saving on the lighting systems.

- Halogens (spot lights) are replaced with infra read Coating halogens.
- Incandescent lamps are replaced with compact Fluorescent lamps (CFL).
- Halogens (flood type) are replaced with metal halides.
- Replacement of the magnetic ballast from electronic Ballast.

5. ENERGY CONSUMPTION

The sanctioned load of mill is 30430.64 KW and also one DG set of 1250 KVA is installed for emergency purposes, when PSEB supply fails. The mill gets supply from PSEB at 66 KV.

Chart -5.1: Energy Consumption

6. A CASE STUDY: LIGHTING

6.1 Observations and Analysis

In this the Observations and Analysis of halogen Lamps, florescent tubes and mercury vapors lamps has been done.

6.1.1 Florescent Tubes

Two sets of florescent tubes consisting of 36 watt tubes were considered.

Consumption of Power of tube & choke = (56+52.7)/ 2

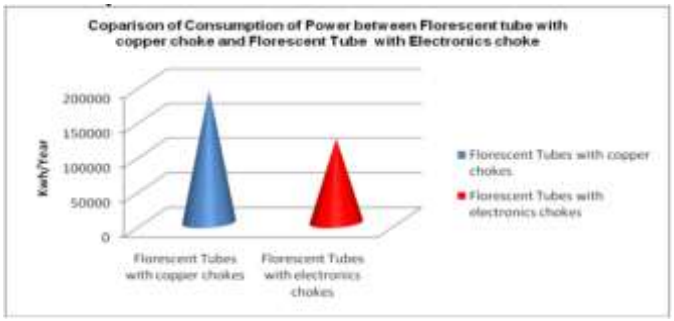

Chart -6.1: Consumption of Power between Copper Chock and Electronic Chock

By processed tube & electronics chokes	34.5 Watts/Tube
watt/tube Difference	20 Watts
Total no. of tubes and chokes	357
Saving	= (357x20) 1000 = 7.14 KW
Saving in unit, if working hrs. And days are assumed to be 10 and 350 respectively.	= 7.14 X 10 X 350 = 24990KWH
Cost of electricity @ Rs. 5.56/unit	Rs. 1,38,944
Price difference between two sets	App. Rs. 260
Cost involved for replacing all the existing tubes and chokes	=357x260 =Rs. 92,820/-
Payback period	= (92820 x 12) 1,38,944 = 8 Months

Table -6.1: Consumption of Electrical Power

6.1.2 Halogen Lamps

There are total 40 halogen lamps in the mill. Each is of 1000 watt rating. Halogen lamps are inefficient as compared to discharge lamps like metal halide lamps saving on this account will be:

Total no. of halogen lamps of 1000 W = 40

Total power consumption = 40x1000

= 40,000 W

= 40 KW

Power consumption by metal halide lamps

= 40x400

= 16 KW

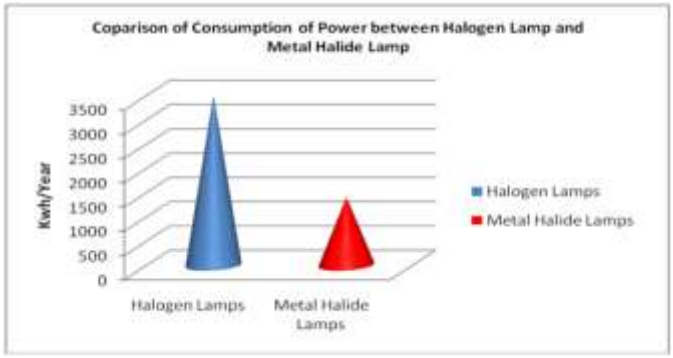

Chart -6.2: Consumption of Power between halogen lamps and metal halide lamp.

Saving	= 24 KW
Saving in unit, if working hrs. And days are assumed to be 10 and 350 respectively.	= 24 X 10 X 350 = 84000KWH
Cost of electricity @ Rs. 5.56/unit	Rs. 4,67,040
Price difference between two sets	App. Rs. 4000
Cost involved in replacement	=Rs. 4000 x 40 =Rs. 160000/-
Payback period	= (160000 x 12) 467040 = 8 Months

Table -6.2: Consumption of Electrical Power

7. A CASE STUDY: LIGHTING ANALYSIS OF A D PATEL INSTITUTE OF TECHNOLOGY, NEW VALLABH VIDHYANAGAR, GUJARAT

As mentioned above we can have analysis of lighting benefits as well as can also save electrical energy by changing it with efficient scheme.

For this purpose we had shown our interest for changing copper ballast light with LED batten in our college itself. And here some result are reflected in order to understand this example more deeply.

7.1 Ground Floor Lighting

Here, as a case study we have mentioned only light load for the calculations moreover also describe what if convectional copper ballast light replaced with latest LED batten.

All the data is wisely segregated classroom wise **[Annexure[1]]**. Further statistical shows that payback period is of 16 Months.

By processed tube & electronics chokes	20 Watts/Tube
watt/tube Difference	16 Watts
Total no. of tubes and chokes	659
Saving	= (659x16) 1000 = 10.544 KW
Saving in unit, if working hrs. And days are assumed to be 10 and 350 respectively.	= 10.54 X 6 X 350 = 22142 KWH
Cost of electricity @ Rs. 5.56/unit	Rs. 1,23,112
Price difference between two sets	App. Rs. 260
Cost involved for replacing all the existing tubes and chokes	=659x260 =Rs. 1,71,340-
Payback period	= (171340 x 12) 1,38,944 = 17 Months

Table 7.1: Ground Floor Analysis

7.1 First Floor Lighting

Same as the ground floor, we had taken data and did some analysis which are as mentioned below. This section is containing various different section such as library including two another department i.e. Computer and Information and Technology. However those two department are having already been pre-installed CFL so no need to reinstall new scheme,

By processed tube & electronics chokes	20 Watts/Tube
watt/tube Difference	16 Watts
Total no. of tubes and chokes	655
Saving	= (655x16) 1000 = 10.480 KW
Saving in unit, if working hrs. And days are assumed to be 10 and 350 respectively.	= 10.48 X 6 X 350 = 22008 KWH
Cost of electricity @ Rs. 5.56/unit	Rs. 1,22,364
Price difference between two sets	App. Rs. 260
Cost involved for replacing all the existing tubes and chokes	=655x260 =Rs. 1,70,300-
Payback period	= (170300 x 12) 1,22,364 = 16 Months

Table 7.2: First Floor Analysis

7.1 Second Floor Lighting

Now, like wise ground and first floor, second floor is not same as above. That means second floor having more amount of laboratory so that may create variation in lighting load.

By processed tube & electronics chokes	20 Watts/Tube
watt/tube Difference	16 Watts
Total no. of tubes and chokes	488
Saving	= (488x16) 1000 = 7.808 KW
Saving in unit, if working hrs. And days are assumed to be 10 and 350 respectively.	= 7.808 X 6 X 350 = 16397 KWH
Cost of electricity @ Rs. 5.56/unit	Rs. 91,167
Price difference between two sets	App. Rs. 240
Cost involved for replacing all the existing tubes and chokes	=488x260 =Rs. 1,17,120-
Payback period	= (117120 x 12) 91167 = 15 Months

Table 7.3: Second Floor Analysis

8. CONCLUSION

As mentioned above all the statistical analysis and calculation, we can conclude that, by implementing new lighting i.e. LED lighting, we can have not mere Electricity saving but also will get high lumens light. However, here we had tried to focus only on lighting but it could also possible for Power load in domestic as well as commercial sector. It may be possible by regular preventing maintenance and using more and more energy efficient equipment. Main motto of the energy audit is to get everyone aware about how much energy we are utilizing and what amount is being waste. Based on all the data and analysis some improvement could be done.

9. REFERENCES

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10. AUTHOR'S BIOGRAPHIES

Keyur Gandhi has completed Bachelor of Electrical Engineering from Gujarat Technological University. Currently working as Quality Engineer at Techno Electromech Pvt. Ltd. Gujarat, India. Many major and minor projects had perform under his leadership. He had also published an International Technical Paper.

Bhargav Lathigara has completed Bachelor of Electrical Engineering from Gujarat Technological University. Now serving as Junior Engineer at Goldi Solar, Gujarat, India. Moreover, he is looking after EPC sector especially designing, execution and liaising work for Solar Projects.

[Annexure]

A. Ground Floor Lighting

Room No.	No. of Batten
101	12
102	8
103	8
104	11
105	8
106	7
107	6
108	7
109	11
110	6
111	6
112	18
113	8
114	7
115	19
116	8
117	8
118	17
119	8
120	8

Room No.	No. of Batten
121	32
122	17
123	8
124	8
125	8
126	8
127	8
128	25
129	31
130	9
131	46
132 - 136	84
137	15
138	31
139	23
140	20
141	25
Canteen	18
Lobby	52

Note: Room no 108 also includes 12 CFL light having 27 W each. Same as Room no 131 is having 4 nos. flood light 100 W each, like wise room no 140 is equipped by 9, 9 W bulb.

B. First Floor Lighting

Room No.	No. of Batten
201	13
202	14
203	12
204	14
205	24
206	4
207	13
208	8
209	8
210	14
211	11
212	8
213	12
214	11
215	12
216	29

Room No.	No. of Batten
217	4
218	12
219	7
220	7
221	12
222-223	15
224	29
225	31
226	29
228	136
229	28
230	30
231	30
232	19
Lobby	59

Note: Here room no 227 is not mentioned as it is two another department i.e. Computer and Information and Technology. Which has already been installed CFL and LED lighting so details of mentioned department is not included here.

C. Second Floor Lighting

Room No.	No. of Battens
301	10
302	12
303	15
304	15
305	19
307	16
308	8
309	8
310	13
311	15
312	12
313	12
314	13
315	12
316	15

Room No.	No. of Battens
317	3
318	12
319	12
320	12
321	16
322	16
323	27
324	28
325	27
326	3
328	30
329	31
330	28
331	7
Lobby	41

Note: here in the second floor room no 331 is equipped by 7 nos. of CFL each having 27 W.