Energy Audit For Annasaheb Dange Medical College Hospital Buildings

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Abstract- *The ever-increasing energy prices, acute energy shortage, forever widening and supply gap, efficiency and conservation measure have gained importance in the recent years. Hospital buildings are using huge energy and the energy saving possibilities is expected to be substantial. This project involved an energy auditing with view to enhance the existing energy efficiency level in the Annasaheb Dange Medical College Hospital (ADMCH), Ashta. Energy Auditing is a systematic study of existing energy consumption pattern and to suggest suitable measures for improving energy efficiency. During the energy audit, a complete survey of power consumption in the Annasaheb Dange Medical College Hospital (ADMCH) was carried out. Audit was conducted for Lighting, Fans, Computers and their power consumption pattern was determined. Energy conservation measures were suggested for minimizing the power consumption in the ADMCH Campus. By implementing the measures, there exists not only scope to save power and money but also conserves our Environment. Implementation of the measures suggested would mitigate of Carbon dioxide emissions, annually in the region. There is a wide scope to conserve energy and environment by conducting energy audit. When this kind of energy audit is conducted all over India, we can imagine the amount of money that can be saved and decreased environmental damage. Thus energy conserved is energy conserved is energy produced. So this audit not only conserves energy but also produces energy.*

I. INTRODUCTION

1.1 GENERAL

Hospital buildings are large energy consumers in many countries. In order to evaluate energy saving possibilities in such facilities an energy audit was conducted in a typical Hospital campus. The audit objective was to provide background for similar applications in all Hospital facilities.

The ever-increasing energy costs and environmental concerns make paramount the rational use of energy and the energy conservation acts. Attention must be paid both in the industry and the building sectors. The last has attracted considerable interest in large scale, country wide, and in small scale, for example residential, commercial and hospital buildings.

Governmental and generally state-owned buildings, especially the old ones are good for conducting energy audits and proposing energy conservation opportunities. Government officials accept easily the idea of audit and collaborate with auditors. Hospital buildings are using huge energy and the energy saving possibilities is expected to be substantial. Many of them are old and present similarities in the building construction and in the other facilities and services because they follow common building codes and practices. Based on the above considerations, an energy audit was carried out in a typical Hospital campus. The audit implementation mode and recommendations may serve as a guide for audits in Hospital campuses country-wise and/or to form a basis for estimations of energy saving investment possibilities in the Hospital sector.

1.2 NEED FOR ENERGY AUDIT

In any building, the three top operating expenses are often found to be energy (both electrical and thermal), labour and materials. If one were to relate to the manageability of the cost or potential cost savings in each of the above components, energy would invariably emerge as a top ranker, and thus energy management function constitutes a strategic area for cost reduction. Energy Audit will help to understand more about the ways energy and fuel are used in any building, and help in identifying the areas where waste can occur and where scope for improvement exists.

The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programs which are vital for production and utility activities. Such an audit program will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating cost.

1.3 OBJECTIVE OF ENERGY AUDIT IN THIS HOSPITAL BUILDING:

The Objectives of the study are to:

- Develop a suitable tool for energy audit for the Annasaheb Dange Medical College Hospital (ADMCH)
- Review the energy related activities in ADMCH
- Measurement and quantification of energy consumption by all utility areas at ADMCH
- Identify areas of energy wastage at ADMCH
- Establishing of energy balance
- Identification of energy improvements opportunities
- Development of energy managements proposals
- Preparation of standard operating practices for efficient use of energy at ADMCH
- Create energy conservation awareness among the end users

1.4 SCOPE OF WORK

- Planning
- Basic data collection
- Measurements and equipment tests
- Data analysis
- No cost/low cost recommendations
- Capital investments
- Action plan formulation

Energy is used in various forms in these hotels, the main being electricity, the others being LPG, other gases, diesel, petrol for the commutation of the employees and for the customers for their travel that is included in the package. Thus all these sources of energy must be quantified and their carbon footprint equivalent is calculated which will provide a baseline information for reducing the footprint thus the energy efficiency measures can be applied and paving way for environmental sustainability.

II. METHODOLOGY

2.1 Objectives

This study was defined to meet the following objectives:
Survey existing lighting conditions and compile inventory on a room-by-room basis;
Identify occupant requirements and concerns regarding light levels in conjunction with the facility manager and key building occupants;
Determine operating schedules and estimate hours of operation based on an estimate derived from metered data, discussions with occupants, and site visits;
Identify lighting quantity and energy savings opportunities with respect to the lighting systems;
Review and analyze existing systems with the intent to present up to three lighting schemes identifying potential lighting upgrades;
Determine estimates of upgrade costs and installation requirements;
Compile results in a lighting feasibility report, to include quantified cost savings and financial analysis, as well as options for partnering with BC Hydro for a demo project.

2.2 Lighting Audit and Analysis

The lighting study includes audits of each the building's lighting systems and controls, an analysis of past retrofits performed, review of alternatives for further energy savings actions and a summary of recommendations. The audits included a detailed inventory of lighting in the buildings2.

This information was obtained through physical, on-site reviews of the lighting system on a room-by-room basis and comparison to past information from the lighting upgrade in 2001 / 2003 and changes implemented since 2003.

2.3Energy Analysis

Lighting energy use was determined based on the audited load and estimates of operating hours. Estimates based on this information were compared to the consumption figures obtained from monthly meter readings or utility account history records (where available) to ensure an accurate and objective analysis. Historical energy usage meter data, as provided by BCIT, from past projects were also utilized as reference for this analysis.

2.4 Measure Selection Criteria

Measures proposed for implementation on this project have been selected based on the viability of the measure against the following criteria:

1. appropriateness for tasks performed in the space;
2. condition of existing lighting systems;
3. cost to retrofit existing system vs. cost to replace systems;
4. low maintenance requirements;
5. consistency of application (all areas of similar function are consistent);
6. overall impact on occupants and general acceptance of changes.

The intent of the outlined criteria is to provide guidelines to determine which lighting measure is appropriate for the tasks performed.

2.5 Cost/Benefit Analysis

Different lighting retrofit / upgrade alternatives were evaluated for first cost, operating cost, maintenance costs and overall system energy performance. During the evaluation process, of the various options reviewed, measures included in this report were selected based on products maximize energy savings, potential for lower maintenance and future component availability costs.

While more systems and technologies than presented in this report were reviewed, those that did not provide adequate performance, energy savings or maintenance savings are not presented in this report or savings / cost estimates.

Overall project budget costs were considered for the Base Retrofit option with the intent to have the overall payback of approximately 10 year plus a positive NPV and IRR for the facilities included in the option. Other options were provided without payback filter to determine maximum savings potential for additional technologies and opportunities.

The readers are reminded to keep in mind that it is possible that costs and fees estimates included in the report could vary be up to 20% less than estimated; true costs will not be known until the work is tendered and market forces dictate the pricing. However, it is not anticipated that costs would be higher than estimated. Additionally, electric utility rebate incentives may also be significantly higher than estimated, based on the interest of the utility in supporting this project as a pilot or demonstration project.

Once various factors are reviewed and verified by other parties (utility rebates for example), the cost benefit analysis can be revised with greater accuracy.

III. SYSTEMS FOR STUDY

1) Lighting Systems

- Measurement of light
- Efficiency / light color
- Lamp lumen depreciation
- Lamp types and characteristics
- Controls
- Energy management opportunities

2) Actions adopted in this audit

- Visual inspection and data collection
- Observations on the general condition of the facility and equipment and quantification.
- Identification/verification of energy consumption and other parameters by Measurements
- Detailed calculations, analyses and assumptions
- Validation
- Potential energy saving opportunities
- Implementation

3) Detailed reporting

- Includes a comprehensive description of the Hospital Building
- The number of lights, fans and computers their type and their hours of usage were noted down. The power consuming equipment in the laboratory were identified and listed.
- Details of the equipment like name of the equipment, hours of usage per day were collected and recorded.
- Data regarding the type of lights, fans and computers their numbers and hours of usage per day and their location were collected and listed out.
- Introduces all profitable energy saving measures in detail, including some comments on implementation, saving calculations, cost estimates
- Ranks the saving measures according to e.g. simple payback time

4) Analysis of data

The data collected were analyzed to identify major energy consumers in energy consumption by all utilities at ADMCH was measured and quantified. From the data, the monthly power consumption (kWh) by ADMCH was determined.

ENERGY CONSERVATION MEASURES

Based on the data collected, low / no cost options were suggested for energy conservation at ADMCH. The feasibility of commonly employed techniques of energy conservation. Energy consumption and costing were analyzed and energy saving potentials were estimated.

ENERGY SAVING CALCULATION

The present status of the energy consumption and the status after the implementation of the proposal were compared to determine the energy savings. Their difference gives energy savings in kWh. For one kWh of energy saved, it is saved to reduce 1.04 kg of carbon di- oxide emissions.

PAY BACK PERIOD CALCULATION

Pay back period is defined as the length of time it will take an investment to 'hat was put in. It is the period required to recover the original or initial cost of the capital project out of the cash inflow generated from the capital project. It is also called as the pay-off or cash recovery period. It is the ratio of the investment required and the savings achieved.

$$\text{Pay back period (in years)} = \frac{\text{Investment (Rs.)}}{\text{Savings (Rs.)}}$$

IV. RESULTS AND DISCUSSION

GENERAL

The purpose of conducting energy audit at Chengalpattu Medical College Hospital (CMCH) was to develop a database to determine the patterns and levels of current energy use and opportunities for cost-effectively reducing energy use within the context of performing the functions intended within ADMCH .

ENERGY CONSUMPTION PATTERN OF ADMCH

During the audit, the energy consumption pattern for lighting, fans, computers and air conditioners at various locations of Annasaheb Dange Medical College Hospital (ADMCH) was studied for 5 days and standard deviation was computed for the operating hours.

Following table shows: Total energy consumed by Lighting, Fans and Computers per day at ADMCH

DISCUSSION

Energy Conservation Measures (ECM) with investment and without investment have been suggested for possible energy savings.The anticipated reduction in annual energy consumption at ADMCH after implementing the Energy Conservation Measures is about 1,07,274 kWh per year.

- List of lightning system Measures suggested for ADMCH

- Turn off lights in unoccupied areas.
  1. Post reminder stickers to turn off lights when leaving the area.

  2. Install time switches or occupancy sensors in areas of brief occupancy and remote areas (warehouses, storage areas, etc.).

  3. Rewire switches so that one switch does not control all fixtures for multiple work areas.

  4. Ensure wall-switch timers function properly.

- Determine if existing lighting levels are higher than recommended levels. Use a light meter to measure light levels and consult the Illuminating Engineering Society of North America (IESNA) illumination standards.
  1. Reduce lighting levels where appropriate.
  2. Reduce lighting hours.
  3. Employ uniform or task delamping to reduce power and lighting.
- Install more efficient ballasts. Ballasts typically have a long life; therefore, replacing ballasts that are still working can be one of the most cost- effective energy improvements.
  1. Upgrade old ballast as lamps are replaced.Pre-1979 ballasts are incompatible with 34-watt energy savings lamps.
  2. This combination will result in a decrease in lamp life of up to 50 percent.
  3. This could include conversion to electronic ballasts and T-8 lamps. Install electronic

ballasts.

- Remove unneeded lamps (delamp).
  1. Remove fluorescent lamps controlled by magnetic ballasts in pairs since they are operated and wired in pairs (two fluorescent lamps from a four-lamp fixture). With electronic ballasts, each lamp is controlled individually. Some facilities have seen an energy savings of more than 30 percent or more from this action.
  2. Remove unnecessary tubes and replace them with "dummy" tubes that draw little current and provide the effect of uniform lighting.
  3. Disconnect ballasts, as the ballast will continue to use energy when the fixture is switched on.
- Install more efficient lighting.
  1. Replace incandescent lamps in offices, workrooms, hallways, etc. with compact fluorescent lamps (CFLs).
  2. Use single incandescent lamp of high wattage instead of two or more smaller lamps of combined wattage. Efficiency of incandescent lamps increases as lamp wattage increases.
  3. Replace non-decorative incandescent lamps with fluorescent or high intensity discharge lamps.
- Use daylighting effectively.
  1. Locate workstations with high illumination needs adjacent to windows.
  2. Turn off lights when daylight is sufficient.
  3. Install light sensors/dimming equipment that automatically compensate for natural light variance.
  4. Clean windows and skylights.
  5. Reschedule housekeeping duties to operate during the day so additional after-hours lighting is not needed.

V. CONCLUSION

Each energy conservation measure should be given a top priority to achieve energy savings and each proposal should be assigned to specific operating or maintenance personnel for implementing and monitoring. All implemented proposals are to be monitored on a proposal by proposal basis for quantifying the actual achievement of savings obtained on a monthly basis. There exists wide scope to conserve energy and environment by conducting energy audit. By implementing the proposals suggested, the following economic and environmental benefits could be achieved.

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