

**Energy Audit and Energy Education
at
Southern University**

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Abstract

Significant amounts of energy and money can be saved by proper operation and maintenance of energy systems. University buildings are usually among the largest single energy consumers. Much of this energy is inefficiently used since most were built at a time when energy conservation was not a concern. In order to assist University administrators in better management of energy consumption and thus saving tax dollars, our engineering team has been performing university campus technical assistance energy audits (UCTAEA) at Southern University Baton Rouge Campus (SUBR).

The energy audit is one of the first steps to perform when initiating an effective energy conservation plan. The UCTAEA program is focusing on educating administrators and operators at SUBR and the discovery and solution of energy and environmental problems. Primary objectives are as follows:

1. Conduct twenty (20) technical assistant energy audits at selected SUBR buildings.
2. Develop an energy conservation strategy plan for the campus.
3. Develop energy conservation guidelines for new and renovated buildings.
4. Analyze campus energy usage by building type, size, function, and operation.

This paper discusses the detail of these aspects of the energy conservation opportunities (ECOS), education, and result of the energy audits at typical HBCU campuses.

INTRODUCTION

Since 1986, the Louisiana Energy Division within the Department of Natural Resources (DNR) has utilized Petroleum Violation Escrow (PVE) funds in a wide range of energy conservation programs and projects. In 1997 and 1998 the Department of Mechanical Engineering at Southern University was contracted by the Energy Division of the DNR to conduct a University Campus Technical Assistance Energy Audit at Southern University Baton Rouge Campus (UCTAEA-SUBR) to help further this effort.

University campus buildings are among the largest single energy consumers. Much of this energy is inefficiently used. For example, our engineering team concluded that commercially available equipment and cost effective measures such as carefully operating heating, ventilating and air conditioning systems (HVAC) and installing high efficiency lighting and energy management control systems could conserve at least 20% of the energy used in the campus buildings with no sacrifice in comfort or productivity.

The failure of campus officials to fully implement the use of energy efficient technologies in the past is a result of a variety of factors. They can be summed up by the fact that the budgets were very tight and the administration looked first to spend its money on the primary mission. Since energy efficiency was not central to the university mission, it received low priority. However, the high cost of maintaining and operating university building today is forcing university into energy savings through changes in operating procedures and retrofit projects. The total energy used by the Baton Rouge campus of Southern University for November, 1997 through October, 1998 was 32,297,704.2 KWH of electricity and 142,302 MCF of natural gas costing a total of \$2,969,694.23. The total energy use and cost will continue to increase during 1998-1999 unless a conservation plan is adopted and put into effect.

During the UCTAEA-SUBR study, our engineers identified numerous energy conservation opportunities (ECOs) while providing twenty-one cost-free technical audits at the Baton Rouge campus. This effort represents a major energy saving contribution by identifying energy conservation opportunities that will greatly reduce energy usage and the cost of operating the Baton Rouge campus. Planning, communications, education, implementation and monitoring are major elements in a successful energy saving plan. However, these efforts must involve everyone at the university. Unfortunately, our experience suggests that although key university administrators express their concern about the high cost of utilities, most department chairmen and faculty have demonstrated little interest in adopting energy savings practices for their buildings. We therefore believe that to achieve the savings goals set by Chancellor Jackson, Associate Vice Chancellor Mr. Moudgil, and Facilities Director Mr. McGhee, two actions are required. First, an energy awareness workshop - strongly supported by top campus officials - should be conducted for all administrative personnel who are in positions to influence energy usage in campus facilities. Second, ECOs found in the twenty-one UCTAEA-SUBR audit reports should be studied and used as a basis for implementing energy saving projects and measures as soon as practicable.

EXECUTIVE SUMMARY

The UCTAEA-SUBR engineering audit team performed twenty-one audits during the period August 1, 1997 through December 31, 1998. The energy conservation opportunities (ECOs) recommended and described in our audit reports represent an estimated reduction of 6,513 632 KWH of electricity and 29,035 CCF of gas worth \$568,732.00. The energy savings potential is an estimated 69,616.2 MBTUs. These savings were calculated with A Simplified Energy Analysis Method (ASEAM) computerized program based on data from the walk-through audits.

Our estimated cost for implementing all recommended energy conservation measures amounts to about \$2,002,572.00, which translates into an average pay back period of approximately three years and seven months. This data represents an average of about 24.42% of energy savings for all buildings. We have analyzed a total of 896,342 square feet of conditioned space using the ASEAM computer simulation program. Although energy usage by individual buildings varied widely, average energy usage at Southern University was found to be 29.8 BTUH per square foot of cooling and 18.4 BTUH per square foot of heating.

Three key actions will shape the success of the Southern University energy saving plan. Each should contribute greatly toward achieving the energy-saving goals.

1. Implement the “Quick Operation and Maintenance Checklist”.
2. Establish an Energy Management Program at Southern University.
3. Initiate a campus-wide energy saving light retrofit project.

Since the objective of UCTAEA-SUBR is to achieve maximum energy savings at the audit sites served we have a great interest in finding out how many suggest ECOs are implemented. However, the scope of work in our current UCTAEA-SUBR program will not enable us to conduct follow-up visits to the audit sites. We therefore suggest to DNR that such a program be developed and funded so as to evaluate the effectiveness of this project and encourage actions required to implement ECOs.

ENERGY EDUCATION

Training and Education are the most important parts of our UCTAEA program. UCTAEA has proposed a half day special Energy Awareness Workshop and Exhibit in Baton Rouge for Southern University personnels (Administrator, Budget directors, Facilities and Physical plant, building managers and interesting faculty). Three major objectives for this workshop are:

- 1.) Introduce and promote the energy conservation.
- 2.) Introduce the latest energy saving devices and techniques.
- 3.) Explain the potential savings from energy efficiency effects and retrofit projects that could be undertaken at the University.

We are also utilizing the existing MeEn 467-469 Topics in Mechanical Engineering and MeEn 493 Senior Project Courses to develop the Energy Conservation and Energy Audit Courses.

These courses will involve engaging interested students from both engineering and architecture, who will commit to a semester long project. The “Energy Audit Course” is designed to provide the students with the fundamental principles of energy audits in commercial buildings. Energy audits will be comprehensive and based on FEMP guidelines.

CONTENTS

- History of Energy Consumption
- Introduction to Energy Conservation
- Thermodynamics Consideration
- Building Envelop
- Lighting
- HVAC
- Energy Management Control System

- Economic Analysis
- Energy Audit
- Audit Project

These students were given training during the first part of the semester and the actual audits began in the middle of the semester. The students were divided into groups, and sent into the campus buildings to conduct their energy audits. After compiling the data, the students spent the next two weeks working with manual calculation and computer input data collections. The results of the compute calculation were then assessed in light of existing equipment in order to search for the energy conservation opportunities. A final report, which summarized their audit and their recommendations, was presented in class.

CONCLUSION

Our twenty-one energy audits of Southern University campus buildings provide a detailed analysis of energy usage along with recommended energy saving opportunities (ECOs) for each building. These energy audits represent the first important step taken by the Southern University in developing an energy reduction plan. Implementation of the ECOs is the next major step to insure success of the plan. Based on observations and information gathered during the energy audits, the following suggestions will help Southern University in establishing management plans for efficient energy usage.

- 1) Implement the “Quick Operation and Maintenance Checklist”.

Building energy conservation equipment cannot function at high efficiency throughout its expected life without periodic maintenance. The proposed checklist will result in more efficient building HVAC operations and consequently reduce energy consumption and unscheduled equipment repair and replacement. An annual energy savings of 5% to 10% can be realized if the checklist is followed.

- 2) Establish an energy management program at Southern University.

An energy management program is nothing more than a series of orderly steps that, if followed, will lead to reduced energy consumption and lowered energy costs.

The planning, development, implementation and evaluation of a University-wide energy conservation program will necessitate participation by everyone at the university. Such a comprehensive energy management program relies heavily on full support by all administrators from the top down.

Key elements in the program are the Energy Management Committee, Energy Conservation Team, and the Energy Audit. Once energy audit reports are completed, the energy conservation team will analyze the results and develop a program of activities with recommendations to the Energy Management Committee. Based on these recommendations, program goals will be decided by the Energy Management Committee. Goals may be organized into time frames.

- (A) Short term - operation and maintenance of system for energy conservation.
- (B) Medium term - retrofit through replacement, modernization, and upgrading system for energy conservation.
- (C) Long term - master plan total energy system for both existing and new buildings.

Translating the energy conservation program goals into objectives and task force activities requires careful programming. Evaluation will tell whether or not the energy conservation program accomplished what it set out to do. This feedback system supplies information for ongoing and future decision making.

3) Initiate a campus-wide energy saving light retrofit project.

Through our energy audit studies over the past seven years, our engineering team has found that retrofitting lighting systems have proved to be one of the most cost-effective means of accomplishing energy savings. Many lighting retrofit projects are simple one-on-one replacements of lamps and ballast with more energy efficient lamps. However, a detailed analysis of the lighting components can result in even greater energy and cost savings by optimizing the lighting application to fit existing conditions. The simple pay back should be less than two years.

4) Implement the energy code for new and renovated buildings at Southern University.

Based on Louisiana Bill No. 1167, in 1997 Louisiana adopted a statewide Commercial Building Energy Conservation Code (CBECC) which meets or exceeds ASHRAE/IES Standard 90.1 - 1989. All state owned buildings are required to comply with CBECC after January 1, 1998. However, ASHRAE/IES standard 90.1 - 1989 serves only as a minimum energy conservation guide. As a member of the State CBECC Technical Committee, I strongly suggested that the ASHRAE/IES standard 90.1 - 1989 should be exceeded by 10% in all new and major renovated buildings at Southern University. I also suggested that a computer load simulation and a life cycle costs analysis should be performed. I recommend these changes be adopted by Southern University.