University System of Georgia

Sustainable Energy Management Plan

APRIL 15, 2007

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1.0 Executive Summary

In response to increasing concerns and expense resulting from the use of and global competition for our traditional energy resources, the University System of Georgia (USG) energy management planning team, led by University of Georgia President Michael F. Adams, constructed a System-

3. The Energy & Sustainability Coordinator at each institution

This training course will focus on methods for improving performance in energy management that will reduce energy costs and environmental impacts. Training will be provided at several convenient locations across the state.

The System will establish a peer network of professionals from each institution who will share expertise and lessons learned that may benefit all members of the System.

BUILDING AND FACILITY ENERGY AUDITS

Establish an audit team at each institution.

Purchase and install utility metering, sub-metering, instrumentation, and controls for buildings and facilities.

The audit team will produce audit data for a manageable number of selected buildings on its campus each year according to a prioritized schedule. Economic analyses and a prioritized list of equipment and building improvements will be provided for each audited building. The total campus audit will be completed within a realistic time frame at some point in the future. Building audits will be repeated only when needed.

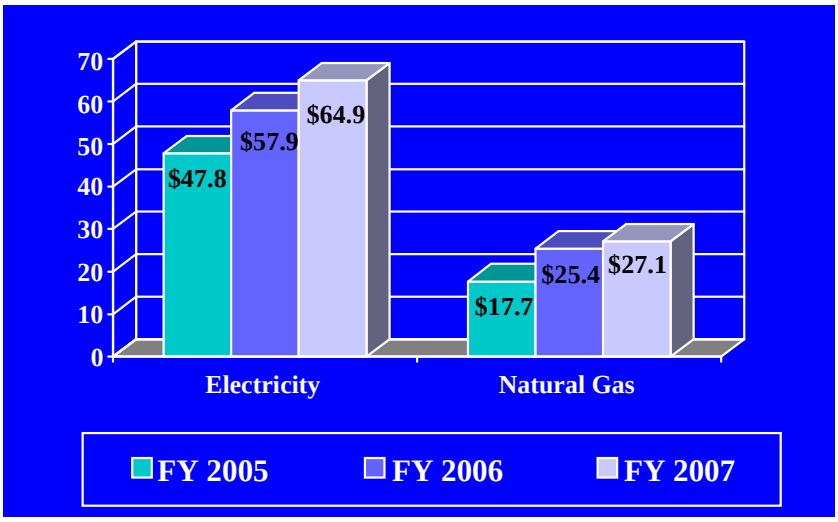
Develop water efficiency guidelines to provide for a minimum 20% reduction in water consumed compared to a baseline using the 1992 U.S. Energy Policy Act.

INVESTING IN ENERGY SUSTAINABILITY

Establish a System-level revolving loan fund for Energy Efficiency/Sustainable Energy (EE/SE) projects that have demonstrable energy savings.
Each institution will invest in energy management.

2.0 Introduction

For Fiscal Year (FY) 2007, the University System of Georgia (USG) budgeted approximately $93 million in general funds for electricity and natural gas – a 43% increase over FY05 spending (see chart below.)



This rise in costs for natural gas and electricity has greatly affected operational costs at System institutions despite efforts across the University System to control consumption andin cos 7(5)]TJ 3*012(tes)]TJ m269(7)2(c)2(iv)-3(ef7(a)2(sv(ct)8(7)-4(n)-4(a)3(.)le)-4(7))7(a)

David Smith, Medical College of Georgia
Betty Sue Story, Darton College
Bob Watkins, University of West Georgia
Steve Watkins, Georgia Southern University
Johann Wells, Columbus State University
Hank Wood, Georgia Institute of Technology

To meet the objective, the group has developed the USG Sustainable Energy Management Plan. The plan incorporates a continuous improvement process to improve System performance now and to adapt to energy challenges and opportunities as they develop in the future. The plan incorporates 'lessons learned' from the participating institutions in the major areas of energy management including campus-wide education and communication efforts, supply-side management of utilities, and energy efficiency and conservation measures for buildings, building systems and facilities. The plan also includes recommended strategies the System should implement now to achieve energy efficiencies, the action steps, and performance indicators to implement and measure the success of those strategies and new strategies as needed in the future.

energy efficiency activities promoted in the distributed literature. Press coverage of the energy initiative is encouraged, especially in the institution's newsletters and periodic publications.

Students bring a wealth of enthusiasm and initiative as well as a different perspective in addressing energy issues. Potential ways to engage students in this process include supporting student organizations dedicated to these activities, using students in promotional activities, and developing curricula related to energy and environmental issues. Each institution should explore ways to involve the entire campus population in promoting sustainable energy use.

The staff and faculty have the responsibility for providing behavioral models for students. Staff personnel are superb teachers and communicate well with students in different ways. Faculty and staff should be reminded to try to teach and set the example for students delivering the message that we all need to take responsibility for greening our campuses. We are mindful that in a learning environment, the person that learns the most is the teacher.

Strategy 3.2.1:
Constituent groups on campus and alumni will be included in designing education and communication strategies to appeal to varying interests.

Representatives from diverse campus organizations will be recruited to be a part of the campus energy efficiency awareness campaign team. Campus environments are well suited for student involvement and leadership in this effort.

Strategy 3.2.2:
USG institutions will survey their campus population to determine triggers that enhance energy efficiency behavior.

As an example, a survey conducted by a public relations campaigns class at UGA in 2006 revealed the following student preferences, perceptions and habits:

1. Students interpret wasteful energy use in classrooms and public spaces (lights left on, space temperatures too hot or cold, etc.) as a lack of

5. Students enjoy competitive events and activities as a way to participate in a campaign.
6. The majority of students would take individual action to reduce energy (turn off lights, put computers to sleep mode, etc.) if encouraged through effective communication.
7. Students are unlikely to report wasteful energy activities on the campus.

Policy Objective 3.3:
USG will develop an energy management peer network.

The peer network will allow each institution's facilities professionals to share best practices in energy management as well as resources and successful methods for promoting energy awareness. The peer network may be web-based and include common file storage infrastructure as well as technology for conferencing and training. Facility benchmark data will be maintained for the network.

4.0 Supply-side Management of Utilities (Electricity, Fuels and Water/Sewer)

The general definition of supply-side management of utilities, from the viewpoint of USG schools, should be the following: Any management activity focusing on the incoming supply of electrical power, fuel, and water, as well as the disposal of sewage, as opposed to activities on the customer side that may impact demand for those utilities.

A simple example of supply-

electric rate structures. If the campus participates in the real-time price purchasing of incremental power, consider all options available. The record keeping mentioned in Strategy 4.1.1 will help to know if better pricing options are possible.

Strategy 4.2.1:
Periodically, perhaps once every two years, a review of records may indicate sufficient increases in efficiency to warrant asking the utility to reset the customer baseline load. This determines the base rate paid to the electric utility. The strategy requires estimating the impact real time pricing will have on the total price paid. Utilities offer this opportunity once per year in the fall.

Policy Objective 4.3:
Consider using a diverse menu of fuels and technologies. Compare the efficiency of energy conversion devices (boilers and chillers) with comparable systems currently available.

5.0 Demand-side Management of Utilities (Electricity, Fuels and Water/Sewer)

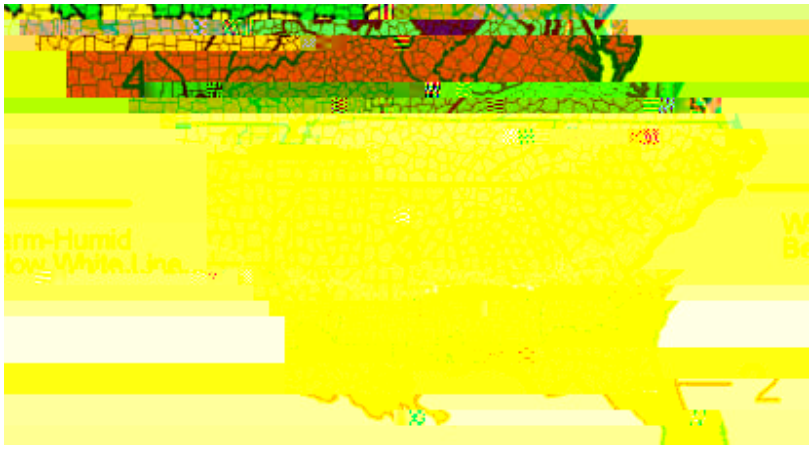
Nationwide, buildings and their related systems use approximately 65% of the total electrical energy consumed in this country and more than 36% of the total energy consumption. For institution campuses these percentages are much higher. While the relative breakdown will vary between different buildings based on their type of usage, the majority of energy use is in building lighting and operating the HVAC (heating/ventilation and air conditioning) systems.

Improving the overall energy efficiency of our buildings and related systems will have positive benefits beyond just the energy cost savings (cost avoidance). As illustrated in the diagram below, we benefit from the reduction in usage of fossil energy resources and from reduced environmental impact from the generation and transportation of energy to each site. Water use is also important to the state of Georgia.

Given two buildings with the exact same usage type and occupancy patterns, the actual amount of energy consumed to operate each can vary greatly. Issues such as the energy standards in place when the buildings were designed and the level of maintenance received since installation help determine the total energy use footprint. Like the human body which benefits from regular medical check-ups, building systems gradually degrade with age and thus a regular program to check and tune-up the systems is part of the overall plan.

The easiest time to reduce the energy consumption in a building is during the design

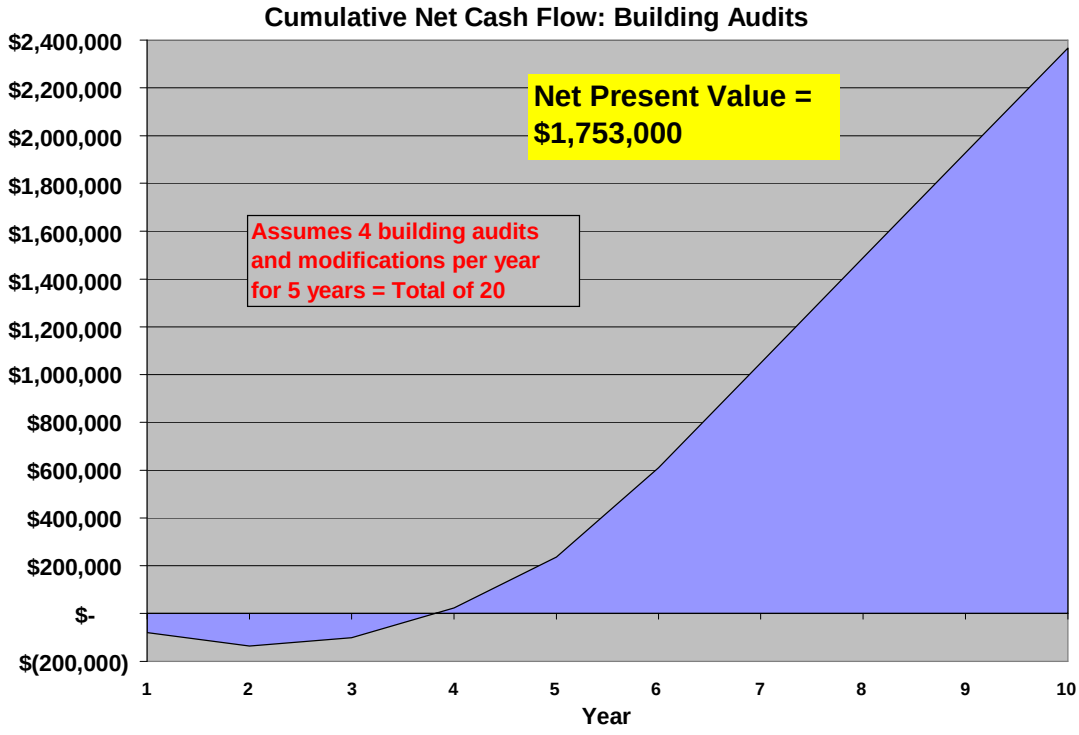
decades to come. Investments in energy efficient systems now will pay for themselves



Strategy 5.1.3:

Strategy 5.2.3:

The implementation of energy efficiency measures will be accomplished using the institution's internal funding obtained through cost avoidance. Improvements may be identified and accomplished by the institution, a consulting firm or through energy performance contractors or a hybrid arrangement. There are advantages and disadvantages with both methods[2]. Based on an analysis conducted in 2006 by the University of Georgia, a small-scale program of four, full-scale building energy audits and retrofits per year for a five-year period would become net cash flow positive by the third year of operation, assuming that energy cost avoidance is funneled back into the program. Only one audit per building is needed. A building will need an additional audit when its energy consumption rises compared to the benchmark. A sample cash flow diagram from this analysis is included in the figure below. A program of the scope necessary to achieve meaningful results could well be an order of magnitude greater than this.



Policy Objective 5.3:

Institutions will compare audited energy use with USG benchmark consumption rates by building size, usage type, age and other key design elements, and will document savings that result from energy conservation measures.

[2] Building Energy Conservation Program: Recommended Course of Action, T. M. Lawrence, May 2006

Strategy 5.3.1:

The university system will help direct resources toward energy efficiency projects to USG buildings that have the highest energy consumption density for their respective building occupancy type and/or toward projects that have the greatest energy reduction payback.

Strategy 5.3.2:

Actual energy savings that result from implementation of energy conservation measures will be documented. The energy audit process can only predict the level of savings expected. Savings must be verified both as a check on the audit process and to document energy savings which result in future avoided costs. The measurement and verification process should meet the standards as set in the *International Measurement and Verification Protocol.*[3]

Policy Objective 5.4:

Existing buildings will undergo a re-commissioning process.

It is common for new buildings being constructed to undergo a commissioning process which helps ensure that the building systems do indeed function as designed. Equipment and systems can get out of tune through normal wear and aging, so existing buildings should also undergo a re-commissioning process. This process checks how systems and equipment are performing compared to their original design specifications, and identifies the changes necessary. A buil4(e)2(c)2(if)5-a17(s)2(d)-4(.)3nd4(s)-2()-12(a)4gy

Policy Objective 5.5:

USG will establish energy and water efficiency guidelines for new buildings.

6.0 Sustainable Energy Management

Effective energy management requires an approach that incorporates best management practices with energy efficiency and cost saving improvements. Effective energy management depends not only on replacing equipment or adjusting operations, but more importantly, on establishing an organizational framework which leads to sustained savings and continual improvement. Many studies have shown that gains in energy efficiency and cost savings are easily lost when an organization does not support the continued operation and maintenance of improvements and does not supply the resources needed to establish a functioning energy management program.

Best management practices i

In addition, key performance indicators (KPI) should be established and used for measuring energy management effectiveness. KPIs are statistical measures that normalize data by associating energy use with organizational output or activity. For a commercial or institutional building, the KPI is typically energy use per square foot. KPI trends will show progress and remove the variability that can occur in energy use, especially when weather is taken into account.

Strategy 6.1.1:
Establish an energy baseline for the University System of Georgia

Energy baselines are the yard stick by which energy savings are measured and should be one of the first activities to be undertaken. Energy baselines consist of energy use and cost data, as well as other facility information that characterizes and shapes energy use and costs in facilities. This data and information is then analyzed and massaged to create an energy management planning tool. This baseline tool establishes a starting point for measuring progress and also provides a comparison against established benchmarks. Comparison to benchmarks is critical for establishing goals and objectives.

This data intensive activity requires significant resources. Key elements of establishing a baseline include access to the energy data, time and personnel to supervise data management and to analyze it, and, typically, a database to house the data and information. Many software tools are available, and a web-based package would allow access to the many stakeholders in the USG.

Strategy 6.1.2:
Create goals, objectives, and key performance indicators for energy management

Once an energy baseline is established, then goals, objectives, and key performance indicators can be developed for the university system. The most effective goals will be those for which there is buy-in from upper management as well as the local stakeholders. A team of university system personnel from a diverse group of units, assisted by Board of Regents personnel should establish these goals. Consultants or third-party experts should be consulted on an as-needed basis to provide assistance. These goals, objectives and KPIs then should be widely communicated to all of the units of the university system to provide guidance for developing their local energy programs.

Policy Objective 6.2:
Every institution within the System will develop a sustainable energy management plan.

A sustainable energy management plan will provide a road map for each institution to meet the University System goals. It will also establish local goals and objectives which will contribute to the broader system goals. A strategic approach should be used which

Policy Objective 6.3:
Reward achievement for meeting energy goals and objectives.

Incentives need to be developed that will reward and motivate the campus energy teams as well as the faculty, staff, and student population that contribute significantly to meeting the goals and objectives of the local college and university as well as the System. Energy management is not usually seen as part of the core mission of USG. Motivation, recognition and tangible incentives are needed from high-level administrators to reward achievement.

Strategy 6.3.1:
Develop incentives for rewarding achievement

Many types of incentives or rewards can be developed. These include recognition as well as monetary incentives. Rewards should be developed at two levels, the system and the local campus. Awarding the campuses from the Board of Regents provides recognition among peer institutions and can also foster competition within the university system. Awards at the campus level are needed to encourage personnel to achieve the goals and objectives developed by the local energy teams. Student energy can be directed through simple competitions.

The retention of a portion of energy savings at the local college or university should be investigated. Cost savings should not be seen as simply lowJ 1 0 0 29vin witb7(t)-25

7.0 Implementation Plan

The successful implementation of a sustainable energy management program at each institution within the University System of Georgia is a high priority for the Board of Regents. A successful program requires a long-term commitment from the students, staff, faculty and the administration of each institution within the System. Obtaining initial traction and maintaining priority over time requires a considered approach that is cemented in place by a plan that gains effectiveness through a continuous improvement system. Such a system requires continuous incentives and recognition to obtain desired results. Energy management plans need to be customized for individual institutions

b. Provide technical assistance
c. Assist with data management
d. Provide economic analysis assistance
e. Assist monitoring and evaluating key performance indicators

3. **Sustainable Energy Management System Trainer and Advisor**: Georgia Institute of Technology Enterprise Innovation Institute
    a. Assist institutions with the formation of implementation and management teams and identification of key performance indicators
    b. Conduct regional energy management system training classes for institution implementation teams
    c. Assist with incremental implementation of Sustainable Energy Management Systems

Action Step 7.1.2:
Establish an Energy Efficiency/Sustainable Energy Executive Committee at each institution within the University System of Georgia

1. Select a faculty and a staff member capable of providing technical and intellectual guidance to co-chair the committee. Alternatively, a non-tenure track faculty with technical and managerial experience may chair the committee.
2. Committee Membership
   The committee will have institution-wide representation and include the following:
    a. Students
    b. Energy/Sustainability Coordinator
    c. Utility Manager
    d. Buildings and Grounds Managers
    e. Architectural Managers, Planners and/or Advisors
    f. Auxiliary Services Manager including Food Services
    g. Campus Communications/Public Relations Managers
    h. Human Resources
    i. Traffic and Parking Managers
    j. Faculty
3. Student Membership
    a. Student Government Representative
    b. Appropriate Registered Student Organization Representatives
4. Faculty Membership
    a. Teaching Faculty in engineering, environmental sciences,

6. The Committee will assist the institution’s Energy & Sustainability

ACTION ITEM 7.2:

Members of the System-level Energy Management Implementation and Operations Team, Institutional Energy Efficiency/Sustainable Energy Executive Committee Chairmen and Co-chairmen and each institution's Energy & Sustainability

team will conduct an economic analysis and determine simple return on investment for identified opportunities.

3. Audit data and a prioritized list of equipment and building improvements will be developed and provided to the institution's Energy & Sustainability Coordinator on a regular basis during the multi-year audit process. Only one audit per building will be needed.
4. The Audit Team will develop and use a re-commissioning program for existing buildings when needed as indicated by an audit (Policy Objective 5.5).

The estimated cost for the university system to support this audit program is approximately $150,000 per year, and it is recommended that the USG fund this program on an indefinite basis as part of the overall implementation funding strategy until all buildings on USG campuses have received a single audit.

ACTION ITEM 7.4:

Establish a utilities accounting system to track cost and usage for electricity, water and sewer, storm water, solid waste, recycling, fuels and steam (Policy Objectives 4.1, 5.1, 5.2, 5.3, 6.3).

Action Step 7.4.1:

USG will establish FY 2006 as the baseline to track utility costs and usage for utilities. Utility costs will be actual expenses and energy usage will be measured in total quantity and BTU per ft^2.

Action Step 7.4.2:

USG Institutions will report FY2007 cost and usage at the end of the fiscal year relative to the baseline and report FY 2008 cost and usage in quarterly reports. USG will determine the electronic format of the quarterly report and the information will be made available in web format "dashboard" to the USG and institutions.

Action Step 7.4.3:

Provide billing for energy consumption for each department within institutions. Issues such as multi-department shared spaces need to be addressed. Where difficulties arise, architects may model a building's energy use to determine appropriate shares. This accountability billing is being used successfully at universities in other states.

Action Step 7.6.3:
Each institution will invest in energy management. This investment should be tailored to the needs and resources of the institution and will include hiring or appointing the Energy & Sustainability Coordinator, energy management or auditing services.

It is recommended that the System-level fund for energy efficiency and sustainability be funded with a minimum investment of $2,000,000 in order to achieve a noticeable level of results. Based on the University of Georgia study, it would be expected that this fund may require additional investment for the second year, but by the third year should become self-sustaining from the big picture through energy cost avoidance.

ACTION ITEM 7.7:
USG will establish a process that rewards institutions for saving costs (Policy Objective 6.3).

Actual utilities expenses saved within a fiscal year will remain in the institution's budget. Institutions will be encouraged to use energy savings from the previous year towards new energy efficiency/sustainable energy projects or to meet any growth in utility costs.

Performance Indicators

Percent of budget dedicated to energy reduction initiatives

Appendix A

Draft Sustainable Energy Management Policy
5/01/2007
University System of Georgia

921 Sustainable Energy Management

The Board of Regents is committed to continuously improving the energy efficiency of its facilities and operations and implementing strategies for energy purchasing and operations. Through this policy, each institution is charged with developing a comprehensive energy management plan that includes, at a minimum, the following components:

Operational temperature standards for all facilities, including night set-back standards and standards during holidays and campus shutdowns

Installation and application of energy efficient standards and efficient equipment and operations in existing, new and renovated facilities

An inventory and audit of each facility envelope and fixed building energy use assets and related equipment

A mechanism for measuring and recording current energy consumption and costs for all operating facilities

A process for periodically reviewing and updating the plan to ensure continuous improvement

Each plan shall meet the approved guidelines of the BOR Facilities Office and be endorsed by the Institution President.

Appendix B

Building Energy Efficiency Case Study

After reviewing sources through the electronic media and existing literature on energy conservation, one finds a recurring theme. It emphasizes tuning up heating and air conditioning systems, re-lamping with more efficient lighting, installing efficient motors, managing energy through scheduling and improving operational procedures. This theme, in fact, was pointed out in an energy audit performed by Georgia Power Company at Columbus State University a number of years ago.

One of the largest potential savings the audit produced was to replace inefficient heating and cooling systems. The power company estimated that $80,000 annually could be saved. To work toward this goal, in-house personnel installed six (6) new cooling towers and seven (7) boilers in the past five (5) years.

The cooling towers ranged between 150 and 350 tons; variable frequency drives and head pressure controls were added to improve efficiency. The towers were purchased with high efficiency motors with belt driven fans to avoid the pit falls of gear boxes. For durability, stainless steel basins were specified to extend the life of the towers. Besides the improvements on the cooling system, the University has also sought a balance and invested in replacing boilers that were truly “dinosaurs.”

To sustain the energy conservation, an investment was made to replace 12 sectional header boilers with energy efficient

The Georgia Power Company also estimates that over $16,000 can be saved annually by tuning up the HVAC equipment on the Columbus State University campus. In-house personnel are performing preventive maintenance tasks on a cyclic basis on heating and cooling equipment to maintain peak efficiency. To achieve this goal, in-house personnel are performing tasks such as cleaning dirty coils, replacing worn belts, and changing filters to keep the cooling equipment efficient. The maintenance staff also performs combustion analysis tests on all boilers to control excess air and prevent any restriction on heat transfer.

Fouled surfaces restricting heat transfer can be taxing on the energy bill; to counter act this, Columbus S

These chillers are alternated according to the cost of natural gas and electricity. To maximize the efficiency of all the chillers, additional steps have been taken.

Columbus State University has taken a page out of the O & M Best Practices Guide (FEMP, 9.4.5, page 32) to manage its chiller operations. The manual states that reducing the condenser water 2 degrees F, 3% efficiency is gained. At the other end of the spectrum, raising the chill water 2 degrees F, 3% efficiency is increased. This is managed through our energy management system.

The EMCS system at Columbus State University is one of the biggest assets. The reset capability of the system allows the facility to manage the HVAC equipment with temperature set points to start and stop equipment. Static pressures in buildings allow Columbus State University to conserve energy by reducing fan speeds and load management. Furthermore, this system allows us to use "free air" by controlling economizers. However, the best feature of Columbus State University's system is scheduling. It is work in progress, but promises huge savings.

Following Georgia Power Company's audit recommendations that were performed in 1999, in-house personnel have made many improvements in the areas covered by the audit. It will be used to manage any future projects and become an "unofficial blueprint" for Columbus State University to manage its energy. The audit concluded that approximately $158,589 could be saved annually by implementing its recommendation; that equates to a 10% savings on the total cost of utilities of $1,017,747 for the year the audit was conducted. By following these guidelines, Columbus State University is saving energy at a level for which most facilities. However, the energy, savings and conservation can be further enhanced through the collaboration among members of the University System of Georgia on energy initiatives.

Initiatives such as forming regional audit conservation and improved operational procedures for maintenance personnel, installing energy efficient equipment and lighting to manage supply side energy, and sustaining efficiency through proper managing will enhance any facility in the University System. The recurring theme of re-lamping, tuning equipment and improving operational procedures can aid in the goal that was discussed by Dr. Michael F. Adams, President of the University of Georgia, for all the System's facilities.

References:

www.eere.energy.gov, O & M Best Practices Guide, chapter 9.4.5, pg 32
Business Energy Evaluation of Columbus State University, Georgia Power, 1999