University System of Georgia

Sustainable Energy Management Plan

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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-level sustainable energy management plan. The objective was to enhance environmental and economic sustainability for System institutions while providing flexibility. This Plan is adaptable, allowing for differences between institutions with respect to any unique mission, size, location, climate, type of building, fuel or energy system employed. Recommendations are suggested that provide the management structure and resources necessary to achieve the objective. These recommendations are as follows:

MANAGEMENT STRUCTURE

- Establish a System-level Sustainable Energy Program Coordinator position to focus on utilities purchasing and to coordinate the System-level energy management performance. The System Coordinator will establish a peer network of professionals and energy coordinators from each System institution and provide guidance for resource allocation, incentives, and recognition on a statewide basis,
- Establish a System-level Energy Management Implementation and Operations Team to assist all System institutions. The team will include the System Sustainable Energy Program Coordinator and representatives from the Georgia Institute of Technology Enterprise Innovation Institute and the University of Georgia Faculty of Engineering Outreach Service to assist with training and technical advice.
- Each System institution will establish an Energy Efficiency/Sustainable Energy Executive Committee to oversee the development and implementation of the Institution's Sustainable Energy Management Plan. Committee membership will include faculty, staff and student organizations,
- Each institution will establish an Energy & Sustainability Coordinator position responsible for implementing and operating the Institutional Sustainable Energy Management Plan and Program.

EDUCATION AND TRAINING

Each member institution will establish programs that communicate the importance of energy conservation. Continuing education will be provided to faculty, students and staff. Sustainable energy management personnel will receive training in a continuous improvement process. Persons to receive training are the following:

1. The System-level Energy Management Implementation and Operations Team
2. The Chairman and co-chairmen of the Energy Efficiency/Sustainable Energy Executive Committee at each institution

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.

UTILITIES ACCOUNTING SYSTEM

- Establish an accounting system at each institution that will track cost and usage of electricity, water & sewer, fuels and steam.
- Establish FY 2006 as the baseline benchmark and track utility costs and usage
- Institutions will report costs and usage for FY 2007 relative to the benchmark and thereafter report on a quarterly basis.
- Utility usage will be recorded in the units of BTU/ft^2.
- Provide billing for energy consumption to each academic department and facility within institutions.

POLICIES, STANDARDS AND GUIDELINES

- Develop a system-wide Sustainable Energy Management Handbook with operational guidelines and specific criteria for all system facilities,
- Adopt and use the new energy efficiency standard for new buildings now being developed (ASHRAE/USGBC/IESNA Standard 189). This standard will result in new buildings using 30% less energy compared to the old standard,
- Develop guidelines for capital projects to include adequate energy metering and monitoring equipment, instrumentation and controls and to construct facilities that use renewable and alternative energy systems when available and practical
- Issue a seasonal temperature guideline for buildings and facilities for all institutions: e.g. 68° F in winter, 78° F in summer.

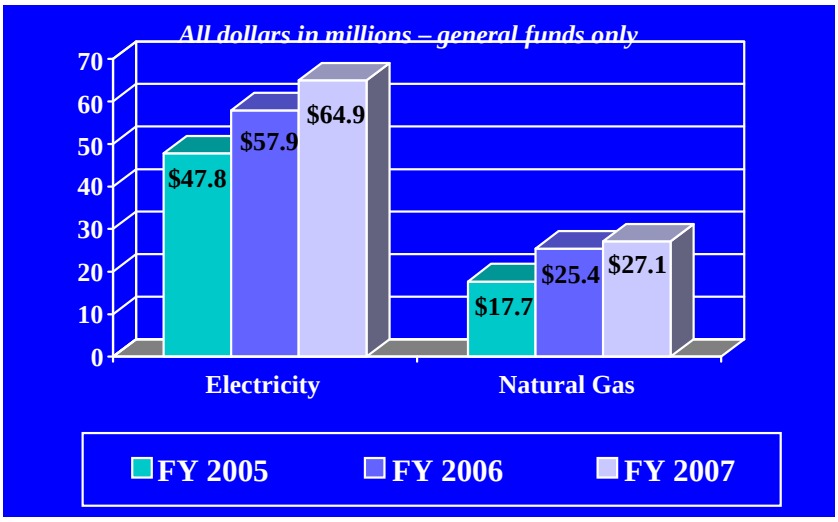
- Develop water efficiency guidelines to provide for a minimum 20% reduction in water consumed compared to a baseline using the 1992 U.S. Energy Policy Act.

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 and negotiate more favorable rates. In Fall 2006, USG Chancellor Davis identified energy management as one of ten major System-wide efficiency initiatives, and asked University of Georgia President Michael F. Adams to champion the initiative.

The objective of this System-wide initiative is to identify, promote, and sustain energy efficiency efforts across all thirty-five University System of Georgia institutions. A working group of the following institution personnel, who represent the various sizes and types of institutions within the USG having expertise in the operational and technical issues associated with energy management, is leading this initiative:

- Tom Adams, University of Georgia
- Dean Brook, Georgia State University
- Ken Crowe, University of Georgia
- Mike Dipple, Georgia Southern University
- Wade Henry, Georgia Perimeter College
- Tom Lawrence, University of Georgia
- Bill Meffert, Georgia Institute of Technology
- Sandra Neuse, University System of Georgia
- Jack Reynolds, Dalton State College
- Ray Sable, Valdosta State University

- 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.

3.0 Education & Communication

The energy efficiency initiative of the University System of Georgia needs the enthusiastic support of the System population. An aggressive constituent education and communication campaign that is inclusive, interactive, sustainable and engaging within the campus environment will provide ownership to our clients as well as the employees of the System.

Policy Objective 3.1:
USG institutions will develop a strategy to promote energy awareness.

The strategy should be tailored to the demographics of the institution. For example, campuses with residence halls should provide programs on energy awareness through residence life organizations. A necessary component of each energy awareness strategy should be a means, such as an informational website or web pages, dedicated to energy awareness and education, to chronicling campus activities, to provide links to other sources of information, and to provide a mechanism to receive suggestions and feedback.

Strategy 3.1.1:
An interactive Internet presence on the web pages of System institutions will be maintained, displaying energy saving tips, interesting facts, events, questions, suggestions and results.

Sustained education and communication is essential because energy management is not a destination, but a process. Many campaigns promoting energy conservation do not achieve the desired sustained results because the education and communication effort is not an integral part of the continuous improvement management system of the institution. Appropriate staffing and prioritization of this function is essential for success.

Policy Objective 3.2:
A determined effort will be made by System institutions to engage students, staff and faculty in the sustainable energy management initiative.

Educational efforts that engage constituents in entertaining activities have the added benefit of creating ownership among the students, staff, and faculty. In addition to notable speakers presenting at seminars and events on topics such as biofuels and renewable energy technologies, events involving active participation by the campus population are effective. Examples of such activities are light bulb exchanges, intramural and institutional competitions, and events on special days such as Earth Day. During a light bulb exchange, for example, participants trade in incandescent light bulbs for higher efficiency compact fluorescent bulbs. During the exchange, participants are given publications relating energy saving information (brochure, sticker, bookmark, etc.) as well as the new fluorescent light bulb. The activity creates a cognitive link among students, faculty, or staff members with the new highly recognizable light bulb and the

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 seriousness and commitment to energy efficiency on the part of the institution's administration and Facilities Department.
2. Students relate energy efficiency to recycling activities. Deficiencies in either of these activities reduced their opinion of the university administration's level of interest in energy efficiency.
3. Students believe their individual conservation efforts impact overall costs and energy consumption of the campus.
4. Visual communication modes (student newspaper, *Facebook*, photos) are most effective. Many traditional methods (mass emails, campus handouts, etc.) have little effect.

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-side management would be negotiating with fuel delivery companies for the best possible unit price for a quantity of fuel. A more complex understanding recognizes that the quality of the fuel purchased affects air quality and utility safety as well as the potential for hazardous spills and pollution to soil and water.

Policy Objective 4.1:

Know the utility purchasing history.

Strategy 4.1.1:

Keep records of purchases for each utility including quantities, total costs and unit prices. Use web-based tracking tools such as EnergyDirect (a Georgia Power service) and/or EnergyCAP, a state-wide utility tracking database currently being implemented by the Georgia Environmental Facilities Authority (GEFA), to help track purchases.

Trend these utility purchases with special attention given to the price per unit actually paid. Knowing the price paid was, for example, $0.07 per kilowatt-hour ($20.50/million BTU) for electricity, $1.25 per therm ($12.25/million BTU) for natural gas, and $9.50 per hundred cubic feet for water/sewer on a certain date along with the quantity purchased is very important.

Strategy 4.1.2:

Think of the unit price as part of an overall energy/utility equation that can be controlled with some planning and effort.

Careful planning and negotiation is required on the part of the utility manager. A lower unit price of electricity, even a fraction of a cent per kilowatt-hour, is very significant compared to the tremendous effort and cultural change required for an equal economic impact from the demand side.

Policy Objective 4.2:

Approach electric utility companies and ask for a complete review of all accounts on the campus.

Depending on actual loads and time-of-use demands, the utility may grant a more favorable tariff. Ask for consolidation of billing for multiple accounts (even if an account is not on a campus grid system) to avoid the high-cost initial tail-step of most

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.

Strategy 4.3.1:
Make the effort to increase the number of different fuels the boiler and other energy conversion devices can use to take advantage of fuel-switching opportunities.

Strategy 4.3.2:
Depending on fuel availability and equipment capabilities, a number of clean-burning biofuels for boilers are available for use. Government regulators are assisting in facilitating fuel switching capabilities. This capability can provide savings when prices diverge. Biofuels provide increased sustainability, may be provided from local sources supporting the local economy and the State. Contact the Faculty of Engineering Outreach Service, University of Georgia for technical assistance.

Strategy 4.3.3:
Consider other renewable technologies, especially solar energy for building hot water, when practical.

Policy Objective 4.4:
Consider purchasing fuels in advance, often termed "hedging."

Strategy 4.4.1:
Track market fuel prices. In the past, purchasing during the summer or early fall was often advantageous. Both biofuel and fossil fuel prices can be highly variable. If state purchasing requirements limit the kinds of fuels and the timing for purchase, alert the USG Sustainable Energy Program Coordinator.

Strategy 4.4.2:
Consider asking for and participating in state-wide contracts administered by the Georgia DOAS. Purchase fuels from the state-approved vendor. Track unit costs.

Policy Objective 4.5:
Review water/sewer rates and storm water handling.

Strategy 4.5.1:
Understand each water account and analyze exactly how sewer charges are related to water consumption.

1. Look for accounts that should **not** be charged sewer charges, such as those having irrigation systems and cooling tower water make-up. If the supplier allows, sub-meter certain accounts to document and avoid sewer user charges. Avoid using potable water for non-potable uses.

2. Recent problems and remediation efforts in the City of Atlanta have caused water/sewer rates to skyrocket almost 75%. In a case such as this, schools in the city system have almost no ability to influence the unit pricing of the water/sewer, so watch the monthly bills carefully for incorrect rates and quantities.

Strategy 4.5.2:
Develop a storm water plan for the campus. Storm water from building gutters and runoff from parking lots and other paved surfaces is a supply of water that can be costly and environmentally unacceptable if not properly managed.

1. Storm water permits are increasingly stringent and some cities have developed or will develop storm water fees. Storm water discharges need to be quantified and characterized.

2. Develop quantifiable methods for minimizing discharges such as providing permeable paved surfaces and other methods for infiltration into the soil.

3. Storm water may be stored and used for irrigation, grey water flush systems and evaporative cooling on roof surfaces during the summer season. Georgia has limited water resources, and System institutions should be models for the state and for students.

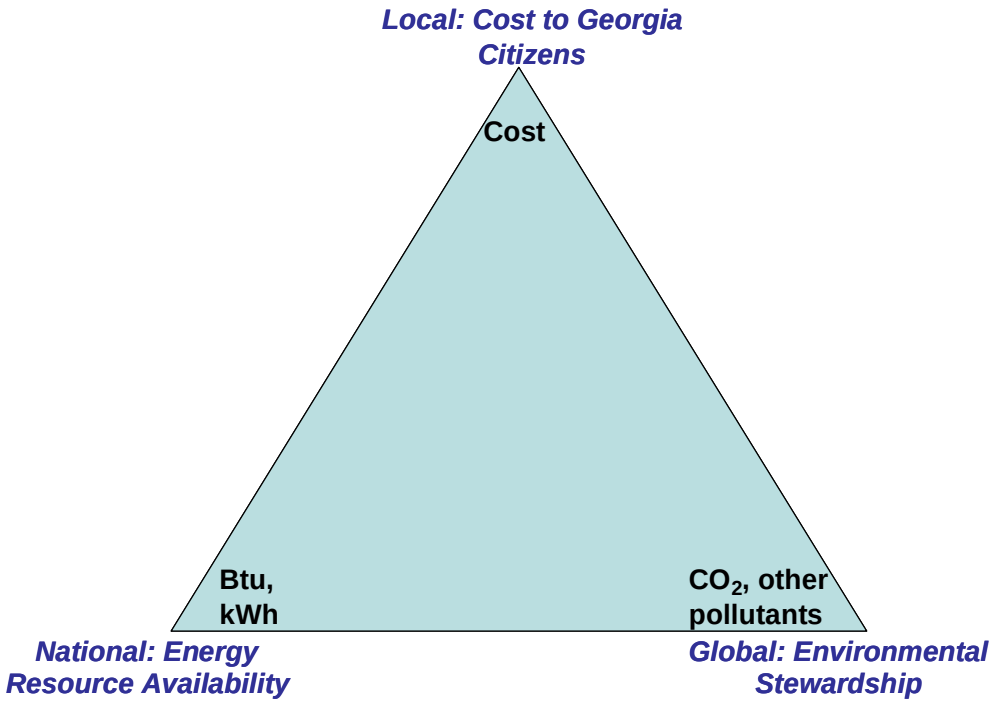
Policy Objective 4.6:
Designate a Board of Regents person/position with full-time responsibility for utilities on a state-wide basis.

Many USG institutions do not have energy management or utilities experts to negotiate, implement and follow supply-side transformations. To mitigate costs, USG will need to create a Sustainable Energy Program Coordinator position to focus on utilities purchasing on a statewide basis and to work with other state agencies/entities to pursue more favorable utility contracts and rates.

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 stage. The buildings now being planned and designed will be in operation for many

decades to come. Investments in energy efficient systems now will pay for themselves many times during the life of the building.

Plan Elements

The key elements of the proposed plan for improving energy efficiency in buildings focus on getting existing systems to operate at their maximum design efficiencies, retrofitting and upgrading with new equipment and technologies, as well as placing an emphasis on purchasing the most efficient systems available for new buildings.

Policy Objective 5.1:

USG will establish and maintain a benchmark for building energy use that will take into consideration climate effects, building type and use.

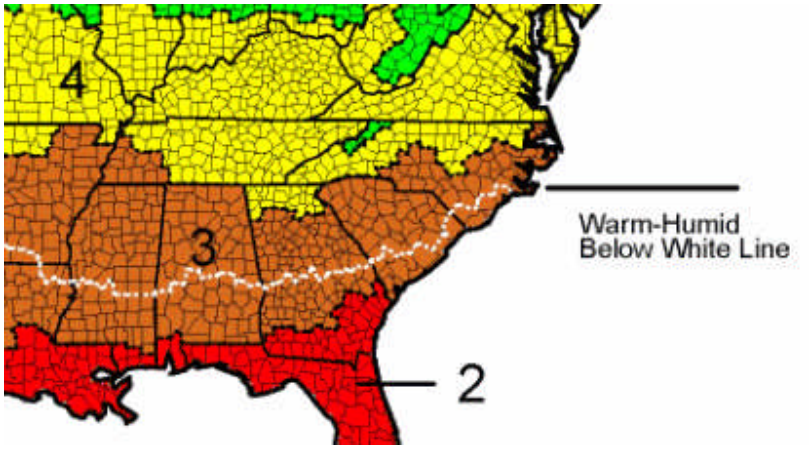
The University System will compile the information necessary to develop a benchmark for energy usage for buildings based on building type and location. A wide variation exists within the System in terms of building occupancy type, climate patterns, centralized versus decentralized heating and cooling systems, etc. Location will be taken into consideration to obtain a normalized building energy requirement for each type and use for buildings encountered within the System. The most common measure used is the annual energy consumption expressed in terms of the key performance indicator (KPI) of total Btu/ft^2.

Strategy 5.1.1:

A survey of current rate of annual energy consumption (Btu/ft^2) of buildings owned and operated by the university System will be computed and summarized. When possible, this will be done on a building-by-building basis, but for some campuses the only possible outcome may be to get a campus-wide Btu/ ft^2 until additional sub-metering is installed.

Strategy 5.1.2:

The energy consumption for the buildings will be compared against similar buildings using national benchmark evaluation standards such as the U.S. EPA Energy Star program. For comparative purposes within the university system, the campuses will be grouped according to climate zones established on a county basis by the ASHRAE energy standard (90.1-2004) and illustrated in the excerpt from this standard below.



Strategy 5.1.3:

The building energy consumption benchmark will be updated every two years to track overall progress, with the goal of improving performance by at least 2% per year.

Policy Objective 5.2:

Each institution within USG will accomplish energy audits for each building and facility on their campus.

The building audit process is a valuable tool which helps identify: (a) what and where are the major energy uses within buildings; (b) where opportunities exist for significant reductions; and (c) a prioritization of the projects for implementation. Building energy audits are a proven means to identify savings opportunities, and one example of where this technique has been successfully applied within the university system is given in Appendix B.[1]

Strategy 5.2.1:

The auditing process may be conducted internally, by outside consultants or using a hybrid approach.

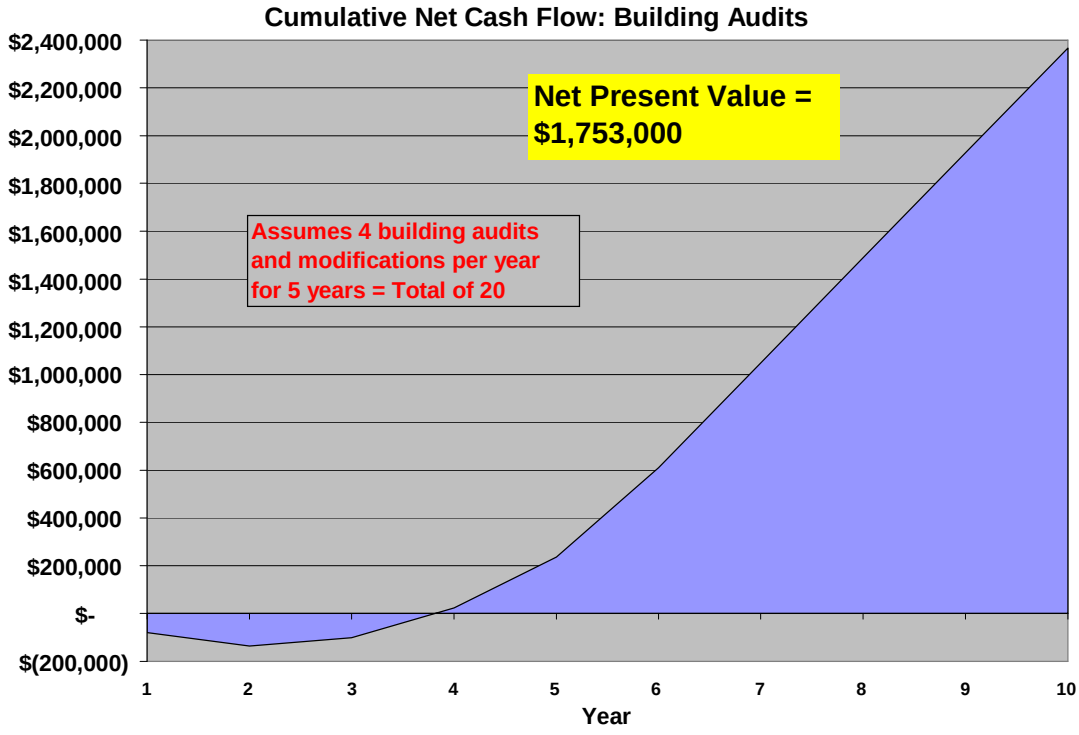
Strategy 5.2.2:

The System will develop a database of lessons learned from energy auditing that can be used to guide and justify implementation of common energy savings projects System-wide.

[1]Business Energy Evaluation of Columbus State University, Georgia Power, 1999

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 building re-commissioning may be one of the energy conserving measures identified during a detailed building energy audit, and although similar in nature it is only intended to tune-up equipment back to the original operating performance.

Strategy 5.4.1:

The building re-commissioning may be performed in-house or using outside firms.

Strategy 5.4.2:

A goal for a minimum energy consumption reduction of 5% should be established for each building re-commissioned.

[3] U.S. Department of Energy, 2002. *International Performance Measurement and Verification Protocol: Volume I, Concepts and Options for Determining Energy and Water Savings.* DOE/GO-102002-1554. Available for download from www.ipmvp.org

Policy Objective 5.5:

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

The energy code for the state of Georgia is based on ASHRAE's Standard 90.1. The current version of this standard does result in energy savings beyond earlier versions (2001 and 1999), but this "code minimum" is not the state-of-the-art in terms of energy efficient design. The American Institute of Architects has set a goal of a fifty percent reduction of the current consumption level of fossil fuels used to construct and operate buildings by 2010.[4] Several design guidelines exist and others are being developed by ASHRAE that will result in buildings using 30% less energy than the Standard 90.1-1999. In addition, the Federal Government in December of 2006 promulgated the regulation which requires all new federal facilities to be designed to use 30% less energy than the energy code Standard, effective January, 2007, unless a life-cycle cost analysis shows it to be impractical.[5] It is very likely that building and system designs which achieve this 30% savings are possible with nearly any building when properly evaluated over the entire life of the equipment. To achieve this level of energy savings (or beyond) requires an integrated building design approach. There is no reason that a similar requirement for 30% savings beyond the current energy code should not be mandated for all university system buildings.

Strategy 5.5.1:

An *Energy Design Guide* will be developed for the USG and used to direct the design of new building construction.

Strategy 5.5.2:

Water efficiency standards will also be developed which provide a minimum 20% reduction in water consumption compared to a year 2006 baseline using methods found in the 1992 U.S. Energy Policy Act.

[4] AIA, 2005. Position Statements, listed on http://www.aia.org/release_121905_fossilfuel and http://www.aia.org/SiteObjects/files/HPB_position_statements.pdf

[5] U.S. Federal Register, December 4, 2006 (71 FR 70275) related to 10 CFR Parts 433, 434, and 435.

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 in business today revolve around the Plan-Do-Check-Act system that Deming established. Standards associated with this systematic approach include ISO 9001 (quality management), ISO 14001 (environmental management), and ANSI/MSE 2000 (energy management), among others. All of these system approaches put forward an organizational framework that allows for effective planning and execution to occur. In addition, these management systems also insure that checks are in place so that projects and management activities are being measured and, consequently, the established goals and objectives are being reached. The system then adjusts or acts to keep the management program effective and on track. By adopting these best practices, the University System of Georgia will develop a world-class energy program that insures sustained savings and continual improvement.

It is expected that the University System of Georgia will adopt incremental improvements to its energy program and provide sustainable energy management training to key energy management personnel at the System and institution levels before attempting to institute a full-scale management system. Consequently, a strategic approach is needed that will move the University System along the best path to effective energy management. The policy and strategies, below, are intended to set the groundwork for developing a long-range energy management program for the University System that is characterized by continual improvement and sustained savings.

Policy Objective 6.1:
Utilize System-wide goals, objectives, and key performance indicators to guide USG energy management activities and its success.

The University System of Georgia consists of 35 units, each of which has a role to play in effectively managing energy. There is great diversity among these units, both in size and energy impacts. To insure that all the units are cooperatively working together to optimize savings and resources, system-wide goals and objectives need to be developed at the Board of Regents level which give guidance to each of the units as they plan and conduct energy management activities on a local level. This will help to frame the sustainable energy management plans that each unit develops.

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

realistically takes into account the resources available and guides the institution down a path to sustainable management. Leaders in energy management have found that there are 5 key elements in good energy management: data management, supply management, demand management, management of energy projects, and organizational integration. Organizational integration is the key element where best management practices are incorporated into the energy program and provide a system whereby all 5 elements hang together and form a whole.

Strategy 6.2.1:
Offer training on creating a sustainable energy management plan to all of the institutions with USG

Training is currently available for helping organizations put together a sustainable energy plan that focuses on the 5 key elements of energy management. Currently, a module entitled, "Creating a Strategic Energy Plan," co-developed by GEM Management Consultants and Georgia Tech, has been presented to more than 1,000 organizations in the U.S. The University of North Carolina System has utilized this training to help it set up its energy program.

Strategy 6.2.2:
Create a peer network within USG to facilitate energy plan development

Resources within the University System of Georgia are constrained. By establishing a peer network, each of the units, regardless of size, can benefit from each other's experiences. With current communication technologies, a web-based peer network could be established with meetings on a regular basis that would facilitate communication and lead to collaboration within the university system. By sharing assets, the university system could optimize its strained resources and lower the time and cost of putting a plan together for the 35 units. This collaboration will help to establish a climate for sharing in future energy management activities such as project evaluation and prioritization, effective communication programs, identifying significant energy uses, etc.

Strategy 6.2.3:
Develop a handbook of energy management best practices

A handbook with best practices for energy management on college campuses will provide direction for USG energy teams. This handbook should contain both technical best practices as well as guidance on how to implement a sustainable energy program. The manual should be a living document that is updated on a regular basis to meet the changing needs of USG and the dynamics of the energy marketplace.

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 lowering the bottom line but a way to contribute to the core educational mission of the university system. If a portion of energy cost savings are allowed to remain at the local level for improving the local educational experience (e.g. building improvements, faculty hires), significant progress will be achieved. Cost savings can also be used as a funding source for continued implementation of energy projects that will lead to further savings.

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 although some elements of plans may be common to all. It is recommended that, as a guide, the Sustainable Energy Management Plan for the University System of Georgia be implemented using the following sequence:

ACTION ITEM 7.1:

Create a management structure to implement and manage operations to achieve the objectives of the System-level Sustainable Energy Management Plan. USG institutions will be mindful that they are providing a model for sustainable energy management for present and future managers in government, business and industry (Policy Objectives 6.1, 6.2).

Action Step 7.1.1:

Establish a System-level Energy Management Implementation and Operations Team to assist all System institutions

1. **Team leader**: The Board of Regents will meet key needs for the sustainable energy management plan, such as the designation of the System-level Sustainable Energy Program Coordinator as the Team Leader person/position with full-time responsibility for utilities and data management for the System. Additional staff will be made available to assist the Team Leader who will have the following responsibilities:
    a. Advise each institution's administration
    b. Provide connectivity
    c. Assure quality guidance for institutional sustainable energy management programs
    d. Provide System-level consultation with utility suppliers
    e. Coordinate a decision support system for providing recognition, incentives and resources
    f. Receive and evaluate data from all institutional sustainable energy management programs
    g. Monitor System-level progress
2. **Engineering Leader and Technical Advisor**: University of Georgia Faculty of Engineering Outreach Service
    a. Teach and assist energy auditing

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, journalism or mass communications as appropriate
    b. Public Service and Outreach Faculty as appropriate
5. The Energy Efficiency/Sustainable Energy Executive Committee oversees the establishment, development and conduct of the Institution's Sustainable Energy Management Plan.

6. The Committee will assist the institution's Energy & Sustainability Coordinator in implementing and managing the Institution's Sustainable Energy Management Plan.
    a. Chairmen/cochairmen will receive training in sustainable energy management.
    b. The committee will assure the policy objectives of the **System-level Sustainable Energy Management Plan** are achieved for each Institution.

Action Step 7.1.3:
Each Institution will establish an Energy & Sustainability Coordinator position.

1. This position is responsible for implementing and operating the Institutional Sustainable Energy Management Plan and Program.
2. The Coordinator will receive sufficient sustainable energy management training to be classified as a sustainable energy management system auditor.
3. The Coordinator is the point of contact for all energy related inquiries and public relations.
4. The Coordinator has these responsibilities:
    - Managing and evaluating data within the energy management system
    - Updating the performance scorecard
    - Reporting sustainable energy management program performance and budget requirements to the institution's Energy Efficiency/Sustainable Energy Executive Committee and the System-level team leader on a regular basis
    - Documenting energy efficiency/sustainable energy improvements
5. The Coordinator works with the building and facilities auditing team and the institution's staff to evaluate and improve utilities (including water, sewage and storm water), mechanical and electrical systems, solid waste recycling and auxiliary systems when needed/warranted.
6. The Coordinator coordinates communication and education activities with the institution's public affairs office.
7. The Coordinator sponsors and assists organizing student and other institutional awareness events and competitions.

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 Coordinator will receive sustainable energy management training (Policy Objective 6.0).

Action Step 7.2.1:

Successfully complete a continuous improvement sustainable energy management course that will reduce energy costs and environmental impacts. The course will be provided at several convenient regional locations across the State.

1. The System-level Sustainable Energy Program Coordinator and Institution Energy & Sustainability Coordinators will receive training at the auditor level.
2. Training will be provided, under contract, by the Georgia Institute of Technology, Enterprise Innovation Institute.

ACTION ITEM 7.3:

Establish a cost effective program to accomplish energy audits for campus buildings and facilities (Policy Objectives 5.1, 5.2, 6.1).

Action Step 7.3.1:

Establish a building and facilities auditing team funded from cost savings (for small institutions, USG may consider providing this service).

1. A mechanical engineer with HV/AC experience will be either employed directly by the institution or under contract as a consultant.
2. Student assistants will be used to the maximum extent practicable.
3. The engineering leader and technical advisor on the System-level Sustainable Energy Management System Team, University of Georgia, will provide training and assistance to the institutional audit team for conducting audits, analyzing results, suggesting improvements and establishing a plan and timetable for implementation.

Action Step 7.3.2:

Build the capability and accomplish periodic building and facilities audits.

1. The building audit team will evaluate the need and suggest a budget and schedule for installing meters, sub-meters and controls at each major building and facility.
2. The Audit Team will conduct energy audits for campus buildings and facilities according to a prioritized list based on estimated energy consumption reduction opportunities. Buildings and equipment will be examined for opportunities to increase energy efficiency. The audit

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 ITEM 7.5:
USG will establish and demonstrate a System-level commitment to ongoing energy management through the development and communication of guidelines, building standards, building codes and policies (Policy Objective 5.6, 6.2).

Action Step 7.5.1:
The BOR Office of Facilities will oversee the development of a system-wide Sustainable Energy Management Handbook with operational guidelines and specific criteria for all system energy consumption issues. The Handbook will address existing, new and renovated facilities, all types of buildings, exterior complexes and systems and also all the types of electrical and fuel using equipment in the USG System.

Action Step 7.5.2:
USG will adopt and use the new energy efficiency section of the standard for new buildings now being developed (ASHRAE/USGBC/IESNA Standard 189). The standard will result in new buildings using 30% less energy compared to ones built using the old standard.

Action Step 7.5.3:
USG will issue a seasonal temperature guideline for buildings and facilities for all Institutions as outlined in the draft energy policy in Appendix A. USG Institutions will ban the use of non-approved supplemental heating devices and appliances for personal use.

The estimated cost for the university system to develop a system-wide Sustainable Energy Management Handbook is approximately $50,000, which should be developed primarily using internal personnel but may rely upon outside contractor input as well.

ACTION ITEM 7.6:
USG will invest in energy sustainability (Policy Objective 5.0, 6.3).

Action Step 7.6.1:
All Capital projects will include energy reduction efforts. All capital projects will include meters or sub-meters or monitoring systems to track the amount of energy used by that facility. An analysis of renewable and alternative energy will be included with each project to reduce environmental impacts and energy costs. A life cycle analysis (full cost accounting) will be used when applicable.

Action Step 7.6.2:
USG will set up a System-level revolving loan fund and/or a mechanism to help institutions develop and use energy services contracts to accomplish energy efficiency/sustainable energy projects. Each institution will gain access to the revolving funds/contracts based on meeting established goals, application procedures, and reporting requirements.

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
- Simple return on investment on capital expenditures
- Estimate of avoided utilities costs based on reduction in BTU/ft^2

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 condensing boilers that could be operated at lower temperatures. The sectional header boilers were operated with inefficient on/off operating controls; where as,
the condensing boilers have modulating air/fuel valves with outdoor resets (temperature).

Some of these are designed to run the year around to control humidity. There have been many successes and savings by installing a majority of boilers in-house. To illustrate this, the Lenoir Science Building project was a huge undertaking by in-house personnel. The existing boiler (4,000 MBH) was replaced with two (2) condensing boilers, rated a 2,000 MBH; a lead/lag control was installed to control the load. However, since the installation of the two (2) boilers, only one boiler runs at any given time with the other on stand-by. By downsizing, this project proved to be very efficient.

Some of the equipment was installed in the 70's and 80's, and designs then tended to oversize systems. Columbus State University's maintenance personnel have replaced a number of commercial hot water heaters that had 400,000 BTU burners with 199,000 BTU, quick-recover heaters that contributed to huge savings without sacrificing service. However, replacing equipment does not guarantee sustained efficiency unless it is maintained and tuned up on a cyclic basis.

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 State University has enlisted the assistance of outside contractors to perform maintenance and water treatment on large tonnage chillers. These services insure optimum heat transfer that prevents major outage as well as maintaining efficiency. Measures such as these increase the overall efficiency of the systems' components.

Devices, such as, motors, can be replaced with higher efficiency ratings. The audit concluded that installing high efficiency motors would create an annual s of $3,300. Unknowingly of this audit, in-house personnel have replaced numerous high efficiency motors to sustain energy conservation. These motors have large windings to reduce resistance and have improved bearings to lower electrical consumptions.

Other than the heating and cooling equipment, lighting systems on campus consume a tremendous amount of energy. The Georgia Power Company audit estimates about a $40,000 annual savings by installing T-8 lamps and electronic ballasts. Columbus State University has taken an aggressive approach to re-lamp classroom buildings throughout the campus. Last year, three major classroom buildings were re-lamped with T-8 parabolic fixtures and our in-house personnel are re-lamping lights that need replacing. Furthermore, Columbus State University's maintenance staff uses parabolic type fixtures with grids instead of acrylic lenses. This satisfies two elements – less housekeeping and more efficient lighting.

The audit found additional potential savings in retrofitting lighting systems in the tune of $10,000 annually. Devices such as occupancy sensors can reduce energy; some of these devices are located in lecture halls and classrooms in portions for the university campus. Most of the parking lot lights and security lights on campus are metal halides; these lamps require fewer watts. In-house personnel are encouraged to exchange incandescent bulbs with compact fluorescent lamps. Recently, in-house personnel have changed out exit lights with incandescent lamps with LED fixtures that are far more efficient.

A significant measure that the power company failed to address was the benefit of improved operational procedures. Fortunately at Columbus State University, there are three (3) chiller plants that have one natural gas driven and one electrically driven screw compressor that gives the University flexibility in keeping supply side energy sources manageable.

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