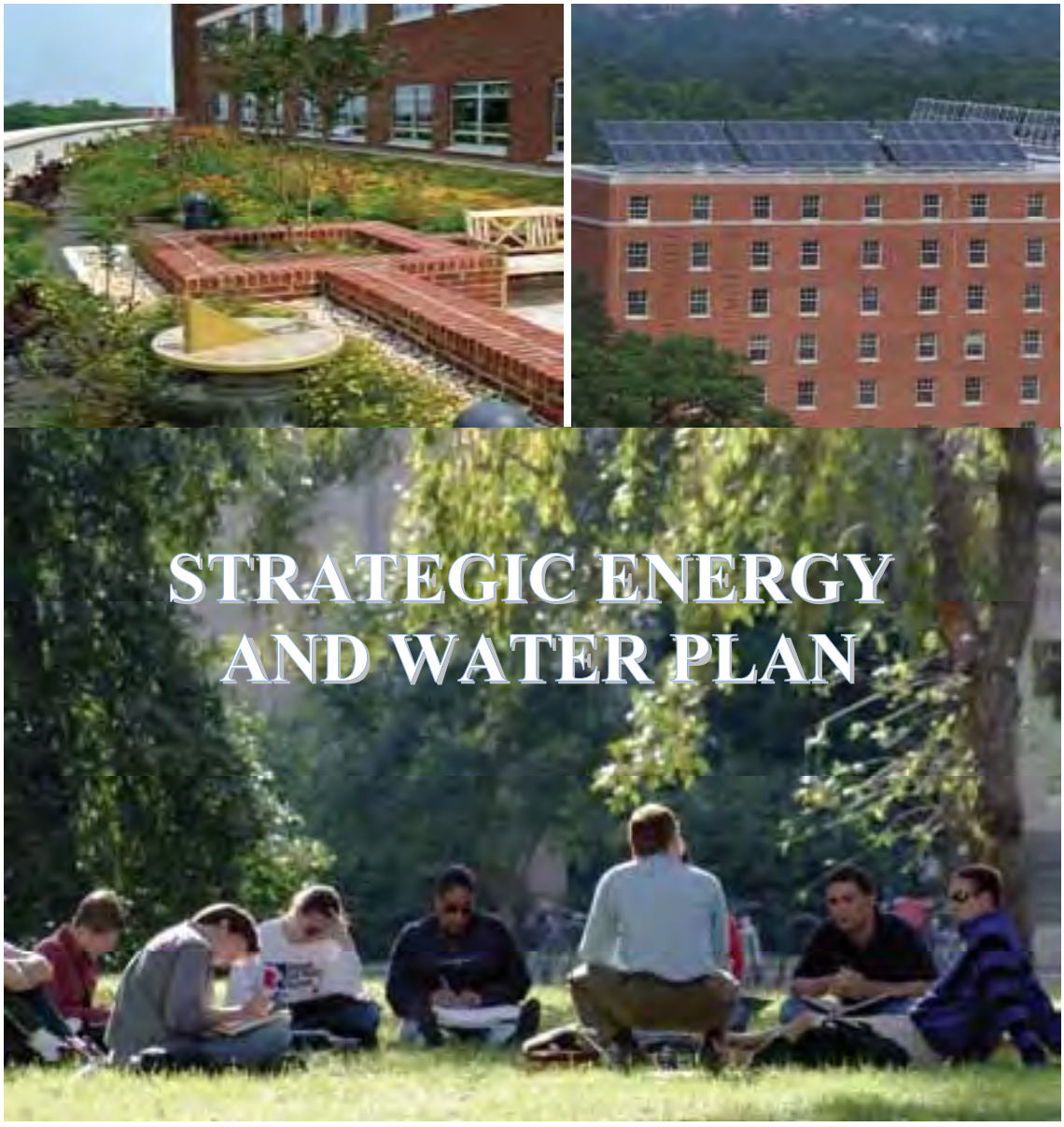
UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL



October 2008

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Executive Summary

The University of North Carolina at Chapel Hill strives toward four strategic energy and water goals:

- Providing reliable, cost effective and environmentally sound energy and water supply and services to support the teaching, research, and administrative facilities within the university
- Utilize energy and water resources in an efficient manner
- Designing and maintaining high performance buildings
- Educating and engaging the campus community in energy conservation

Underlying the University's utilities infrastructure plan is our District Energy System. District Energy Systems produce and pipe steam, hot water or chilled water underground through a dedicated piping network to heat or cool buildings in a given area. District Energy Systems reduce energy costs and greenhouse gas emissions, while freeing up valuable space in campus buildings by centralizing production equipment. District Energy Systems optimize the use of fuels, power and resources through economies of scale and equipment management, and diversifying load. Additionally, central energy distribution systems increase reliability through increased redundancy.

Today, the University's Energy Services provides heating, cooling and distributes electricity to 700 acre central campus which is comprised of over 250 buildings and an enrollment of around 28,000 students.

Data presented in Table 1 was extracted from Energy Service's billing records. Gross square footage represents the total space calculations from the Engineering Information Services Plan Room as of June 30, 2008. UNC Hospitals, Energy Services, and separate state agencies are not included in either consumption or gross square footage data. Energy Services' operating costs are captured in the University's utility rates which are indirectly reflected in Table 1.

Table 1: Six-Year Record of Progress in Energy Reduction **

Year	Total Energy Costs	Total GSF	Energy Costs per GSF	Total mmBTU	BTU per GSF	% Change in BTU per GSF relative to 2002-03
2002-03	$47,524,510	13,477,719	$3.53	2,238,334	166,077	
2003-04	$46,743,474	13,537,153	$3.45	2,144,554	158,420	-5%
2004-05	$48,554,958	13,623,133	$3.56	2,186,333	160,487	-3%
2005-06	$56,756,725	15,680,862	$3.62	2,317,352	147,782	-11%
2006-07	$63,826,422	15,974,743	$4.00	2,471,158	154,500	-7%
2007-08	$71,145,683	17,101,612	$4.16	2,487,742	145,300	-12%

**Building square footage was changed for 2006-2007 to reflect more accurate records obtained from the Engineering Information Services Plan Room, which has measured and verified gross square footage for each building on campus. Additionally, the energy costs and consumption were modified slightly for 2006-2007 to add consistency in reporting by eliminating other state agencies from our report.

Table 1 above shows the progress that was made in reducing energy consumption per square foot since 2003 by 12%.

In FY08 funding increased and this is reflected in the improved reduction in energy consumption (BTU/SF), see Chart 1 below. This reduction is probably conservative since again many projects were not completed until late in the fiscal year and subsequent energy/water savings cannot be observed yet. This delay in project completion was due to many things:

- Normal time to design, bid and construct a project
- Time for new project identification and assessment
- Project opportunities that arose late in the fiscal year

Chart 1: Six-Year Record of Progress in Energy Reduction

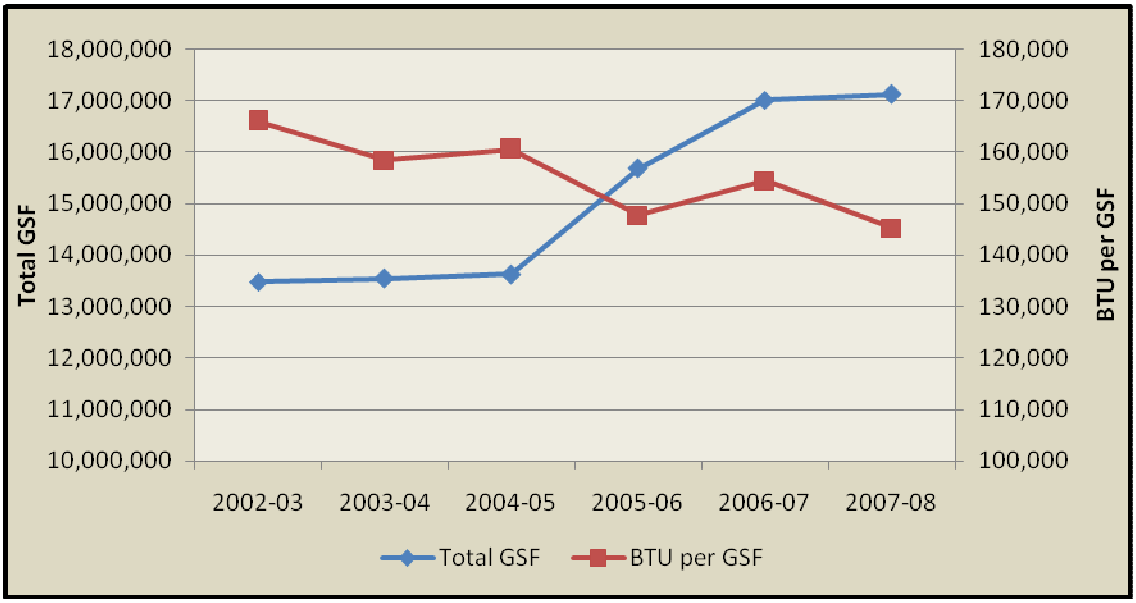
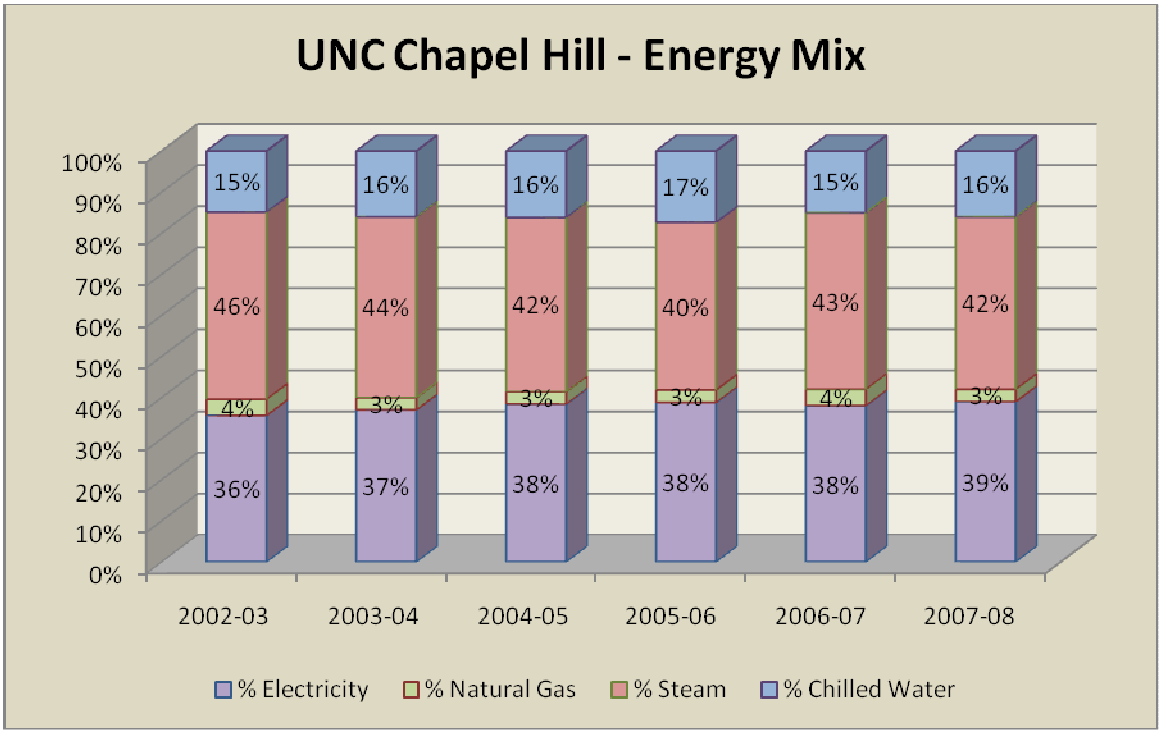


Chart 2 shows the university's energy consumption mix, electricity, natural gas, steam and chilled water since FY2003. For FY2008, steam was 42%, electricity 39%, chilled water 16% and natural gas was 3% of the energy consumption.

Chart 2: Energy Mix



Energy Use in Facilities

This year brought significant change to the University with respect to energy and water conservation efforts. Facilities Services, in an effort to provide a consolidated focus on conservation, established a new department, Energy Management. This department combines existing resources including commissioning, energy engineering, data analysis, and the Energy Management Control Systems shop. Though most of these positions existed, the department still has to fill six positions in FY09 and create new business processes to support conservation. A Greenhouse Gas Emissions Specialist was hired to inventory and track emissions and to develop a climate action plan to mitigate those emissions.

In FY08, $1.2 million was provided by the University Budget Committee for energy projects. Additional resources came from operating and capital budgets. These funds were used for the projects identified in the appendix and covered the following areas:

- Strategic Planning
- Energy Assessments
- Retro-commissioning
- HVAC
- Lighting
- Water Conservation

Strategic planning included the first phase of a Strategic Demand Side Energy Plan for the entire campus. Chart 3 shows the diversity of energy use across the campus. The solid bars show average energy intensity (KBTU/GSF) across different building types. The thin vertical line shows the maximum and minimum intensity for each building type. This great range of energy intensity is one reason formulating a comprehensive plan is so complex. When completed, this plan will provide an assessment of the energy opportunities across campus and a strategy for selecting new projects.

Energy assessments included lighting surveys of twenty six buildings to evaluate the potential for lighting upgrades. HVAC assessments included new air filter technologies, pressure independent chilled water valves and a redesigned heat recovery system in Hooker Lab. They also included an investigation of high airflow in a major laboratory building.

Retro-commissioning included reprogrammed controls and hardware improvements in four buildings. A pilot project was also completed to reduce the number of air changes per hour in four laboratory rooms.

HVAC projects included installing new energy efficient motors and variable speed drives on air handlers, automatic controls on boilers, improved building insulation and restored

economizer operation. Building Services' HVAC Controls shop self-installed a new building automation system in Tarrson Hall that has reduced chilled water consumption.

For the third year Facilities Services continued a program of shutting down building HVAC systems during unoccupied hours. Twenty buildings were in the program this year. In addition to expanding this program, Energy Management plans to install wireless temperature sensors in these buildings so that we can prevent them from getting too hot or too cold during unoccupied hours.

Lighting projects included the installation of new energy efficient lighting in more than 1.5 million square feet. The campus has a goal of eliminating all T-12 lamps on campus by 2010. Projects also included occupancy sensors, improved daylighting and a whole building lighting control system in Carrington Hall. Several pilot studies to evaluate LED lighting were also completed in Giles Horney and Morrison Hall.

Water conservation projects included the installation of dual flush valves in 57 buildings. A serious underground hot water leak at Woolen Gym was discovered and repaired. Active preventive maintenance can do as much to conserve water as new technologies.

FY09 should see the completion of a number of projects that were started in FY08. These include:

- Strategic Demand Side Energy Plan
- Surveys of campus lighting and economizers
- Air change reduction in a major lab building
- Additional lighting upgrades
- Additional dual flush valve installations

The next fiscal year will bring closure to significant efforts at data capture including interval (live) and monthly energy and water data and building automation data. The ability to weather normalize the consumption data will also be developed in FY09 through the use of a commercial utility tracking software.

Once the data is in place to quantify conservation efforts the department will begin more rigorous analysis of the measurement and verification of energy related projects. Additionally this will provide baselines for future projects.

It is expected that future conservation efforts will encompass a mix of formal engineering/contractor projects and smaller projects to be completed in-house. Projects will begin as energy audits of buildings showing high usage for their building type and then will identify energy conservation measures (ECMs) from these audits and actionable conservation projects. Of particular focus will be reduction of airflow in laboratories. The in-house projects will include expansion of night setback/shutdowns for buildings, surveys of the status of existing air economizers and repairs as necessary, and static pressure optimization for buildings where this was not done during construction. Energy

management will also work on water conservation through more installations of dual flush toilets and identification and correction of trap coolers installed where sterilizers are rejecting steam condensate to the sanitary sewer system. It is anticipated that many of these are sub-cooling the water thereby increasing water consumption.

Energy management will also complete design standards for energy and water efficient construction and renovation projects.

Chart 3: Energy Intensity by Building Type FY08

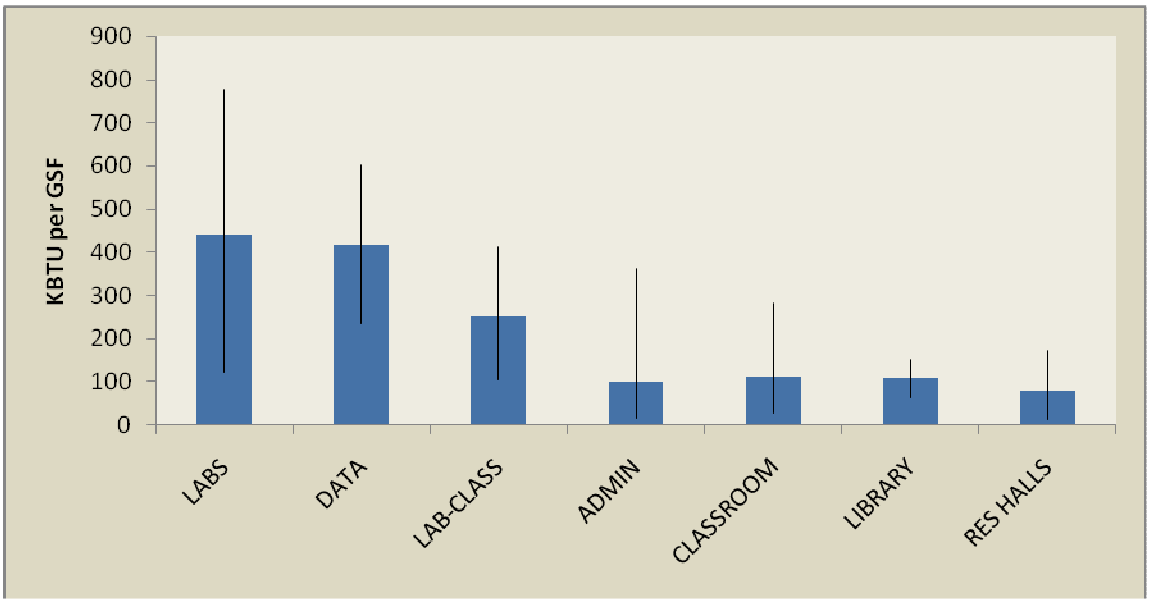


Chart 3 shows energy consumption by building type for those building types that are the predominant energy users. As expected, laboratories and computer centers use three to four times as much energy as do the other building types.

Energy Supply

Cogeneration

The Cogeneration Facility generates and distributes steam to the campus which is used for heating, humidification, domestic hot water heating, sterilization and making distilled water. During the cogeneration process, the steam passes through a 32 MW turbine generator. As a result, up to one-third of the electricity used on campus can be produced as a byproduct. This combination results in an overall thermal efficiency of twice that of any plant built solely for the purpose of power generation.

In addition to maximizing energy efficiency, cogeneration significantly minimizes the impact to the environment. Coal, the most plentiful and economical fuel available, is used primarily; however gas and fuel oil can be used as backup. The facility relies on advanced circulating fluidized bed (CFB) technology and continuous air emissions monitoring equipment ensures compliance with all State and Federal air quality regulations

Energy Services has completed installation of Black Start Diesel Generators, greatly enhancing the reliability of the steam and electricity production, by allowing the plant to restart its boilers should Duke Energy's system not be available. These generators also enable the University to save money by generating more electricity when Duke's hourly prices are high.

A new cooling tower has been placed into service with enough capacity to meet the re-rated turbine generator (28 MW to 32 MW) cooling needs. Additionally, Energy Services is completing a long term project to replace a significant amount of main steam and hot water distribution piping. The new piping is better insulated, and is larger where appropriate, both of which help limit distribution system energy losses.

In conjunction with other construction projects, almost 10 miles of new steam and condensate piping has been installed over the past 10 years. Yet by consolidating older, smaller networks, the overall length of pipe has remained relatively constant. This improved network has increased the amount of steam reaching customers by 7 percent since 2000. Today, approximately 91 percent of the steam leaving the central plant reaches its destination before it condenses and is returned to the plant to be re-boiled.

Nine thousand feet of aging hot water pipes and 7,000 feet of steam lines have been replaced since 2000. Because the new lines are better insulated and larger in diameter, more net energy is delivered to campus buildings. This increased thermal efficiency is equivalent to saving approximately 10,000 pounds per hour in steam production, enough to heat 1,600 average homes.

The Cogeneration Facility has been recognized by the EPA's Combined Heat and Power Partnership program over the years for its greenhouse gas emissions reduction with the latest award received on December 14, 2007. The facility produces 0.256 metric tons of carbon equivalents less than a typical heat and power facility. This is equivalent to planting 13,556 acres of forest or removing the emissions of 9,037 automobiles.

The University is currently studying alternative fuels for its energy supply as part of its commitment to reduce its carbon footprint. This study will be ongoing over the next year, and will be examining alternative fuel sources for both its existing energy production as well as new facilities for its future Carolina North Campus.

One outgrowth of this study is a project the University is currently negotiating with Orange County to utilize landfill gas as a fuel source to provide energy to Carolina North. Landfill gas is a potent greenhouse gas, and its destruction has significant environmental benefits. The project as envisioned would provide electrical energy for the existing Facilities Services complex on Airport Drive and for Carolina North as it develops.

Chilled Water

Chilled Water, which is used to cool buildings and equipment, is provided by either the District Cooling Systems comprised of a network of chiller plants and underground piping or by stand alone chillers dedicated to individual buildings.

The District Cooling System for the main campus consists of five chiller plants with a combined capacity of 50,000 tons. The plants are interconnected by underground piping and operated as one production system using a networked Supervisory Control and Data Acquisition (SCADA) system. From a single console, operators can manage and balance loads among the chiller plants, use capacity anywhere in the system and continue operating in critical areas despite cooling equipment failure or utility outages.

Two of the chiller plants house both steam absorption and electric centrifugal chillers; the other three house only electric centrifugal chillers, allowing quick response to outages of either energy source, as well as management costs through monitoring the local electric utility's hourly pricing program. Steam absorption chillers provide a steam demand that makes the cogeneration operation more efficient during hot weather. Also, they help balance the steam usage from winter to summer and provide better utilization of the steam infrastructure.

System Efficiency:

Overall district cooling system efficiency is measured using Coefficient of Performance (COP).

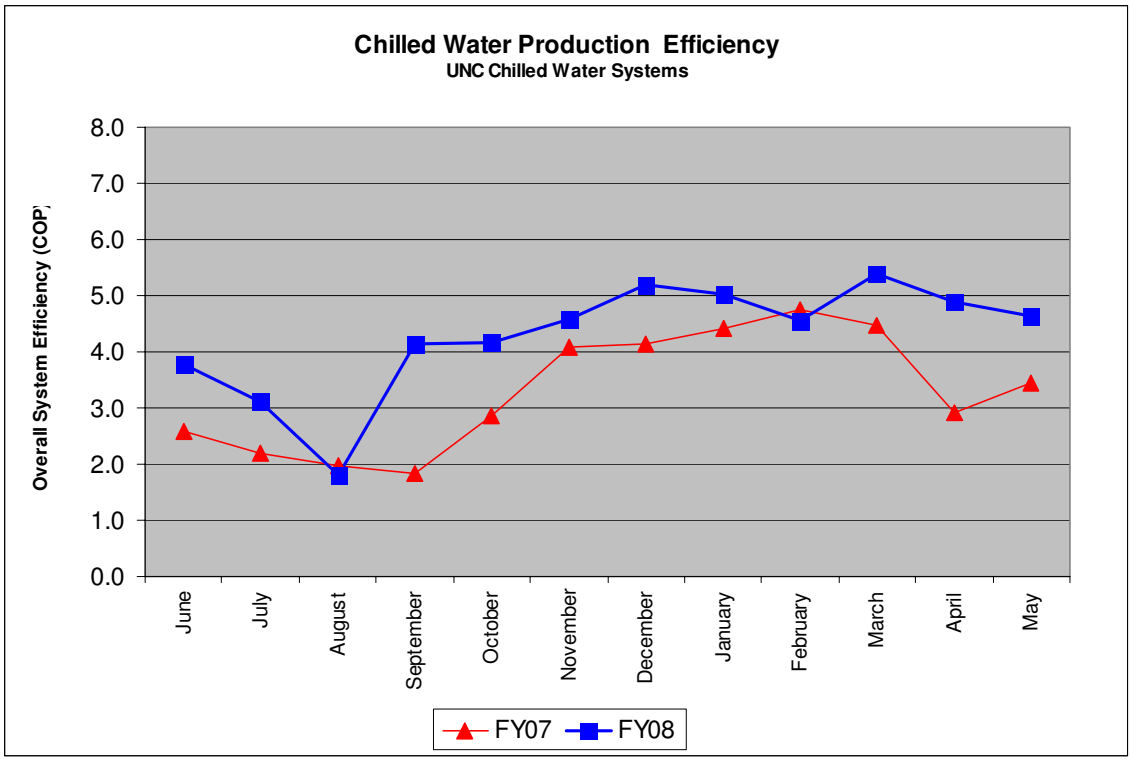
COP = (Useful Cooling Work) / (Input Energy)

FY08 COP = 3.413 which was a 30% improvement over FY07 COP = 2.615.

Year to year changes are be attributed to:

- Less absorption chiller operation. Steam driven absorption chillers are less thermally efficient than electric chillers (COP of 0.6 versus 4.6 for electric chillers) so less operation increases overall system efficiency. Steam driven absorbers are operated during peak electric price hours when they become less expensive to operate than electric chillers.
- Decreasing minimum condenser water temperature set points from 65F to 55F. A one degree of decrease in condenser water temperature increases chiller efficiency by approximately 1%.
- Increased focus by the Operators on optimal dispatch of the most efficient chillers.

Chart 4: Chilled Water Production Efficiency FY07-FY08



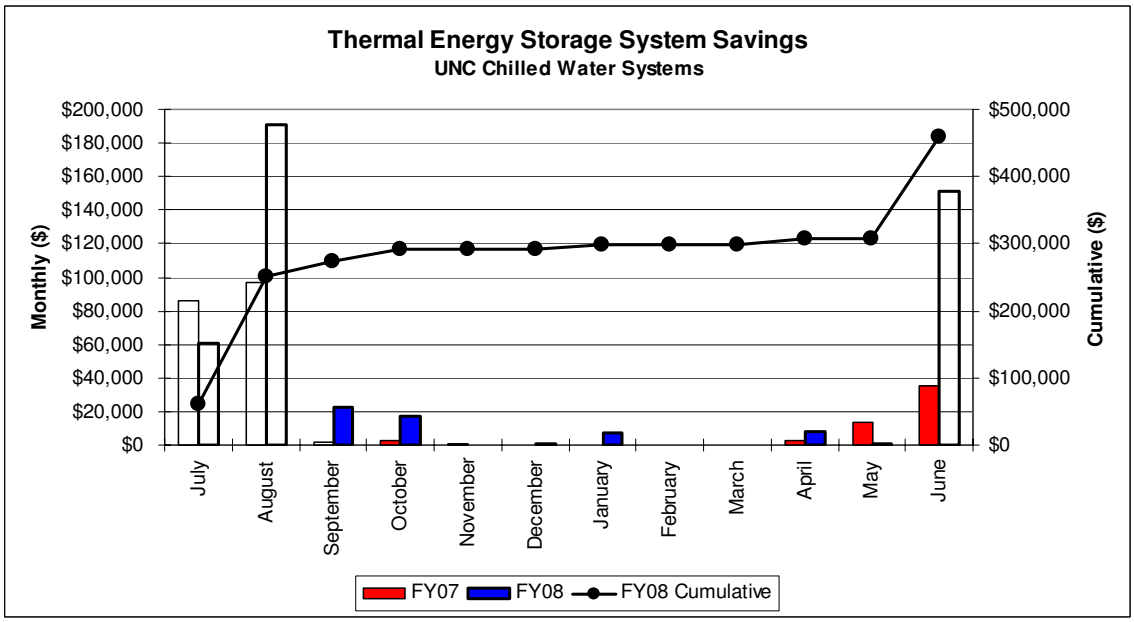
Thermal Energy Storage:

The Gary R. Tomkins Chilled Water Operations Center completed its second year of service in FY08. It includes a 6,000 ton chilled water plant and a 5 million gallon stratified cold water Thermal Energy Storage (TES) system. The TES system shifts a

portion of the university's chilled water production to off-peak periods, reducing the need to purchase electricity from Duke Energy during peak times and at peak electric rates.

Operation of the TES system saved the University $458,656 in electric costs during FY08 which is a 90% increase from FY07 savings of $241,781. Savings were increased due to a new strategy of blending warm (55F) chilled water returning from campus with the 39F water in the TES tank during discharge. This allows maintenance of acceptable 44F supply temperatures to campus while turning off approximately 40% more chillers during tank discharge. The tank was also cycled 44% more in FY08 than FY07.

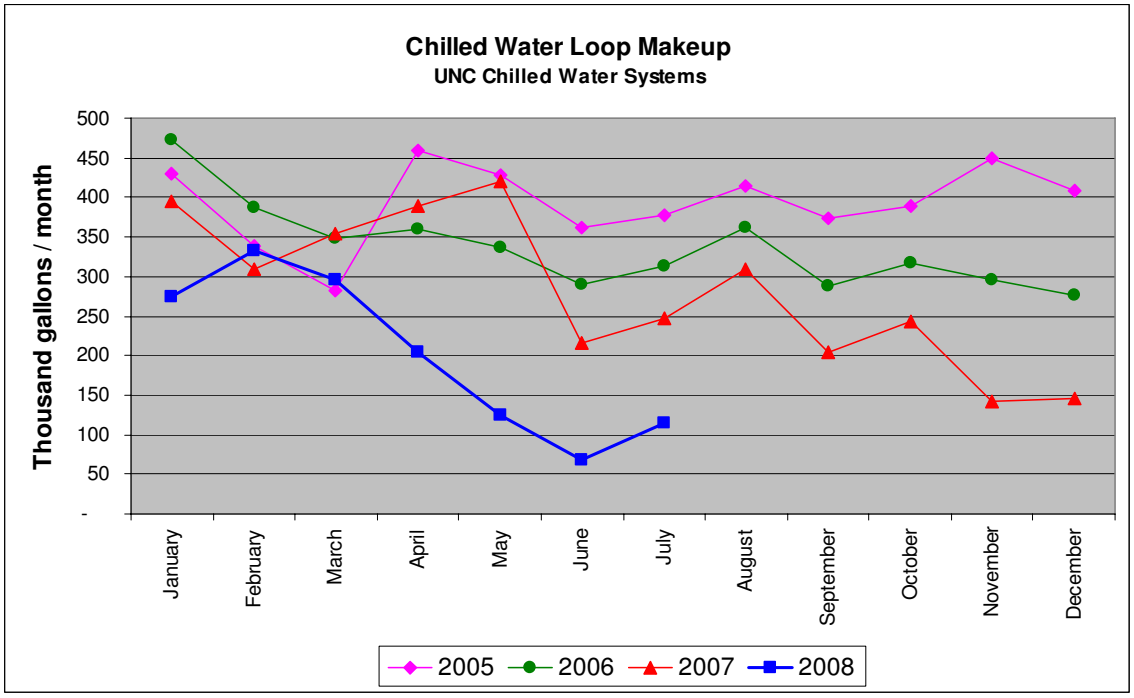
Chart 5: Thermal Energy Storage System Savings FY07-FY08



Distribution Piping Leak Repairs:

Chilled Water Systems has continued its efforts to reduce leakage from our 22 mile distribution system. Close monitoring of leak rates and regular piping isolation tests have helped locate and repair several large leaks this year. Total FY08 loop makeup was 1,344,000 gallons which is 34% lower than the previous year. This improvement reduced FY08 water and chemical costs by approximately $50,000.

Chart 6: Chilled Water Loop Makeup



Tomkins Operations Center HVAC Improvements:

Occupancy schedules were applied to all HVAC equipment in the building. This effort resulted in 45% reduction in steam and chilled energy consumption.

Chart 7: Tomkins Cooling Load FY07-FY08

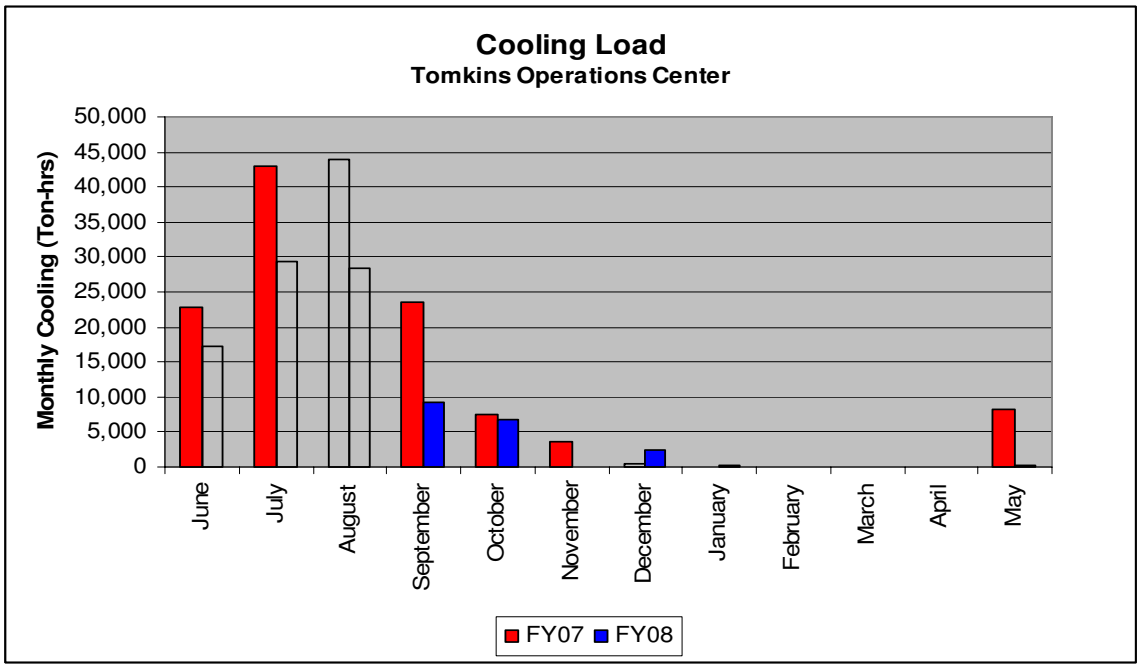
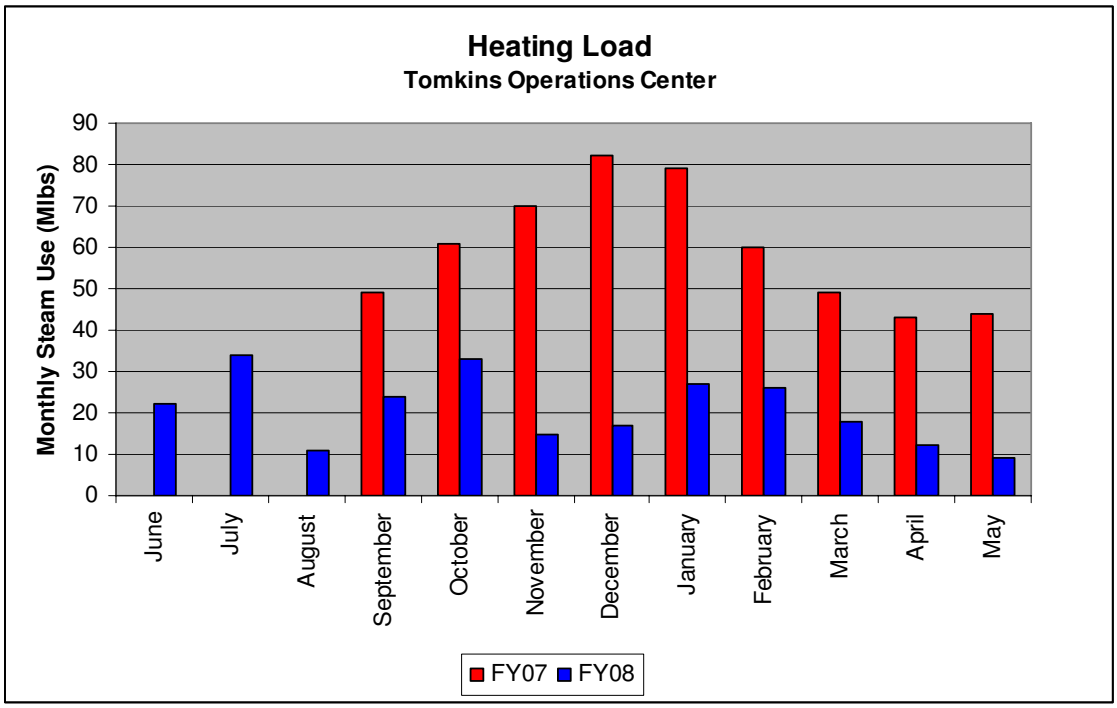


Chart 8: Tomkins Heating Load FY07-FY08



Electric Distribution

Electric Distribution Systems receives power from the local utility provider, Duke Energy, and the Cogeneration Facility. The University operates its own electrical distribution system extending from the substations to each of the individual buildings serviced. This system is comprised of 820 electric and telecommunication manholes tied together through 39 miles of duct bank containing 59 miles of underground cable and operating at a voltage of 12,470 volts. This power is delivered using 33 high speed automatic switches and 177 manual switches serving 423 transformers.

Energy Services continues to update the electric infrastructure system to ensure adequate capacity for all campus existing and new loads. Development and implementation of the Supervisory Control and Data Acquisition (SCADA) system, including the fiber optic metering system is underway.

System updates and expansion continues with the development and improvement of capacity and reliability at all three substations. The transmission system from Duke Energy is being converted at each substation to new Gas Insulated Switchgear technology for the 100 kV system. This is expected to result in an increase in reliability of the transmission service and higher system capacity. In addition, transformer capacity is increased with the replacement of existing transformers by newer, larger transformers and the addition of the larger transformers at the Cameron and Manning substations. Circuit capacity has been increased with the addition of switchgear at Cameron, Manning and South substations. This dramatic increase in capacity and accompanying reliability changes in circuit arrangements and numbers will provide for the system load increases projected through 2050.

The SCADA system is in place and operating to provide monitoring and control functions for all the circuits at the substations. Work continues to complete the installation of the fiber optic cables that will allow interconnection of all the circuits and relay-equipped high-speed switches installed in the circuits to monitor and control operations, and to also provide for meter data transmission and load information at all the meters connected into this system. These improved communication components are also required to use the high-speed switches in a closed loop configuration. The loops provide for improved reliability in fault handling to mitigate outages.

Fiber communications being installed to all major building meters connect to a metering server. This allows energy management systems to continuously monitor electric consumption to each building.

Data Management

Energy Management continues to work on an energy consumption database reflecting monthly usage for all utilities including water. This will provide an ability to monitor monthly and annual energy and water consumption for steam, electricity, chilled water, water, natural gas and propane. Additionally it will provide the ability to compare one building to another, one month to another for either a specific building or a building type, and also to compare building types. Expected completion is in FY09.

The Enterprise Building Management System (EBMS) completed integration of building systems data and is in the process of data verification with the assistance of University Facilities Services personnel. This will provide access to historical and current (real time) alarming, reporting, trending and scheduling for nearly 35,000 existing data points on campus. Expected completion is November 2008. Additionally the EBMS project successfully completed integration with steam distribution data providing real time and trending analysis of steam consumption data for each metered building.

Part of successful completion of the EBMS project includes integration of Chilled Water interval data and Electric Distribution interval data. Energy Services and Energy Management are developing the process to provide interval consumption data for chilled water and electricity. Completion is expected by October 2008. This interval data, provided by Energy Services, will be used for building diagnostics and to verify operational savings resulting from energy upgrades. A central data repository contains five minute interval consumption data from Cogeneration and Chilled Water.

Electric Distribution's SCADA system will provide this interval data for all service units by 2010.

Energy Services implemented a new website that provides online utility cost and consumption data to its customers. Customers are able to access and compare their current and historical monthly utility cost and consumption data by utility, account, or service unit. The new website also provides Energy Services' employees, customers, and other users with an informative and dynamic website encompassing each of the functional areas of Energy Services and educates and creates awareness for energy conservation.

Organizational Integration

Teaching

Faculty in Business, Environmental Sciences and Engineering, Public Policy, Social Work, and Physics regularly integrate issues of climate, energy and environmental impact into their coursework. In 2006 students in a graduate Social Work course developed an extensive rating instrument for the local Chamber of Commerce to use in setting up a Sustainable Business Certification Program, which includes energy and water efficient facilities and use of non-vehicular transportation. The Chamber is now testing this rating instrument across the country.

Curriculum

The University's Institute for the Environment now offers a Sustainability Minor, two new core courses on sustainability, and a Sustainable Triangle field site in addition to the several dozen courses already incorporating a sustainability perspective. In 2008, Environmental Studies capstone students inventoried greenhouse gas emissions related to university funded air travel, developed a resource conservation learning module for Wachovia bank employees, and created an archive of climate change lectures in conjunction with Focus the Nation. In 2007, the Center for Sustainable Enterprise in the Kenan-Flagler Business School launched the Business Accelerator for Sustainable Enterprises – the first accelerator designed specifically to support businesses that address financial profitability, social equity and environmental sustainability.

Extra-curricular

Many service learning courses and student organizations, such as the Carolina Environmental Student Alliance, Net Impact, Students Working in the Environment for Active Transformation, the Student Environmental Action Coalition, the Renewable Energy Special Projects Committee, the Environmental Affairs Committee of Student Government, and the Roosevelt public policy institute provide students with the opportunity to apply what they learn in the classroom to public service. These groups work closely with the Sustainability Office to conduct facilities inventories and tours, staff events, and share information with the campus community. Several new student groups include the Morrison Sustainability Theme Housing Community; the Epsilon Eta environmental honors fraternity, the Fair Local and Organic foods group, and Focus the Nation, which printed hundreds of sustainable t-shirts with instructions on how to reduce your carbon footprint.

Research

Among the many research centers at the University, the Center for Sustainable Energy, Environment, and Economic Development and the Center for Environmental Modeling

for Policy Development focus on policies to promote energy conservation and the impacts of energy use. The Institute for Advanced Materials, Chemistry Department, Astronomy Department, and Physics Department each research materials and technologies that harness renewable energy sources and meet regularly to share their progress. A Greenhouse Gas Emissions Specialist was hired to inventory and track emissions and to develop a climate action plan to mitigate those emissions.

Outreach

Special outreach events in the past year have encouraged community discussion of energy and water conservation and climate change. These include poster presentations and talks by Senator Janet Cowell and former Chancellor James Moeser in conjunction with Campus Sustainability Day, campus participation in the national Focus the Nation teach-in, a student-led Energy Fair in conjunction with Carolina Green Games, and climate change lectures by Michael Shellenberger and David Orr in conjunction with Earth Week events. Community resources have also been developed and distributed that communicate the energy and water conservation goals and practices of the university. The *2007 Campus Sustainability Report* was distributed to over 3,000 decision makers across the state. Informational brochures are available for select campus buildings, new websites on "Save Energy" and stormwater management have been launched, and the Morehead Planetarium and Science Center developed a multimedia exhibit on high performance buildings.

In Morrison Residence Hall a new touch screen display was installed in the lobby to show students how energy is used throughout the building. The system includes a website allowing students to compare suites or floors to another for energy conservation competitions. It also provides information on the operation of the solar water heating system.

Media coverage of campus sustainability initiatives is on the rise. The Sustainability Office distributed over 4,000 compact fluorescent light bulbs and printed post-it notes for housekeepers to leave in office spaces that haven't yet replaced their incandescent lights. These activities are in addition to ongoing outreach campaigns by such student groups as the CESA, SEAC, Net Impact, and SWEAT.

During the drought of 2007, members of the campus community received regular emails reminding them how to conserve water. The Chancellors at Carolina and N.C. State engaged their students in a contest to reduce water use. Housekeeping Services discontinued window washing, Grounds Services stopped washing vehicles and using purchased potable water for irrigation, and Dining Services permanently stopped using food pulpers and trays.

Public Engagement

In response to the system-wide UNC Tomorrow Initiative, Carolina developed a comprehensive strategy to incorporate sustainability as a core value in its teaching, research, operations, and community engagement. The Environmental Finance Center expanded its GreenGov listserv to include state agency members of NC Project Green. The Sustainability Office introduced many campus and community members to low impact Segway transportation. The University appointed a liaison to the Town of Chapel Hill's new sustainability committee and to the board of the Chamber of Commerce's Foundation for a Sustainable Community. The Carolina North committee continues to actively solicit and incorporate community input during the planning of this model sustainable campus.

Water Resources Management

The University has partnered with Orange Water and Sewer Authority (OWASA) on a reclaimed water system to supply the campus with highly treated reclaimed wastewater. The reclaimed water system will bring reclaimed water from OWASA's treatment plant to the campus for use in Chilled Water system cooling towers, for toilet flushing and irrigation. The University also is planning to use reclaimed water as a back-up to stormwater in cisterns as part of a non-potable water system to be used for toilet flushing and irrigation.

The University installed 5,450 feet of reclaimed water pipe with other utility projects in 2004-2007, and contracted to install an additional 2,450 feet and complete the on-campus system in 2008. The University is funding all the costs of the system not covered by grant funding, some of which also is being installed by OWASA. The OWASA-installed work includes a 600,000 gallon storage tank and associated chemical treatment facility, and 9,300 feet of reclaimed water line from the wastewater treatment plant to connect with the piping installed on the University campus.

Initial use will be in cooling towers at the East, South, Tomkins, and North chiller plants and as back-up for the Bell Tower Cistern which will provide water for the Kenan Football Stadium irrigation system. The next phase will include extending the system to the Cobb chiller plant and providing back-up for the Hooker Fields cistern in providing irrigation water for Fetzer Field, Navy Field, and Boshamer Stadium. In 2011; the Genome Sciences Building will use this water for toilet flushing.

The Fed-Ex Global Education building uses non-potable water from the cistern for toilet flushing. NC Botanical Garden Visitor Center will be using reclaimed water toilet flushing.

In response to the drought, a University action committee met regularly and discussed the drought status, water conservation, and measures taken. The group developed a critical building list regarding water use which can be used if water rationing is required.

Table 2 below shows the university's progress in water usage reduction on campus with an overall reduction in FY2008 from FY2003 of 25%.

Table 2. Six-Year Record of Progress in Water Usage Reduction

Year	Total Water Usage (Gallons)	Total GSF	Water Usage kGal per GSF	% Change in Usage per GSF Relative to Previous Year	% Change in Usage per GSF Relative to Baseline 2002-03
2002-03	387,548	13,477,719	28.75		
2003-04	362,461	13,537,153	26.78	-7%	-7%
2004-05	369,062	13,623,133	27.09	1%	-6%
2005-06	374,107	15,680,862	23.86	-12%	-17%
2006-07	389,071	15,994,557	24.33	2%	-15%
2007-08	368,533	17,101,612	21.55	-11%	-25%

APPENDIX

Energy Use in Facilities

Past Year Accomplishments	Measurement	Annual Savings Actual/Anticipated	Cost	Funding Resource
Person Hall HVAC and Roof Replacement	Energy consumption	TBD	$1,012,365	Higher Education Bond
Peabody Hall Windows Replacement	Energy consumption	TBD	$263,791	Higher Education Bond
Commissioning 5 campus buildings: 590,321 GSF	Energy consumption	At least 5% utility expenses per building	$875,000	Bond, Department or Hospital Funding
Lighting surveys: 26 campus buildings 2,153,982 GSF	Future planning	Will depend on the final cost to retrofit these lights	$9,841	Budget Committee
Lighting retrofits (lamps, ballasts, and fixtures) on 7 campus buildings: 332,608 GSF	Electric consumption	$9,534 / 9.4 year payback	$89,268	Budget Committee
Lighting retrofits (lamps and ballasts only) 7 campus buildings: 447,502 GSF	Electric consumption	$106,102 / 2.4 year payback	$258,456	Budget Committee
Lighting control projects on 8 campus buildings: 748,671 GSF	Electric consumption and LEED certification	$6,566 / 6.5 year payback	$42,422	Budget Committee
Remove incandescent light bulbs from task lighting on campus	Distribution of 4,000 free compact fluorescent bulbs to campus departments	$17,449 / 0.6 year payback	$10,962	Operating Budget
Pilot LED Lighting: Giles Horney Morrison Hall	Electric consumption	Experimental use of LED lights. $191 / 14 year payback	$2,672	Budget Committee

Retro-Commissioning Energy Projects: Van Hecke Memorial Hall Ackland Art	Energy consumption	$28,356 / 3.3 year payback	$92,320	Budget Committee
HVAC Projects: Giles Horney – Boiler Controls	Energy consumption	TBD	$7,283	Budget Committee
Lab Energy Projects: Thurston-Bowles Hooker Lab Fordham Lab Kenan Lab MBRB	Energy consumption	$99,563 / 3.1 year payback	$313,340	Budget Committee
Insulation Project: Ackland Art Museum	Energy consumption	TBD by utility metering	$33,876	Budget Committee
Pilot Economizer Projects: Murphy Hall	Energy consumption	TBD by utility metering	$15,888	Budget Committee
Maintenance Projects: Bingham Hall - CO2 sensors Rams Head - CO2 sensors Tarson Hall – DDC controls	Energy consumption and IAQ	TBD by utility metering	$23,280	HVAC Maintenance
Building Shutdowns: 20 buildings 1,460,879 GSF	Energy consumption	$63,000 in chilled water savings alone	NA	Budget Committee
Renewable Energy Projects: Fetzer Gym - Solar hot water Chapman Hall - PV panels	Energy consumption and greenhouse gas reduction	Studies for future projects	$27,297	RESPC
Future Planned Activities				
Warranty Commissioning: Sitterson Addition Physician's Office Bldg	Energy consumption and operation	TBD	TBD	Capital Budget

Construction Commissioning: Genetic Medicine Arts Common	Energy consumption and operation	TBD	TBD	Capital Budget
Other Commissioning 8 campus buildings	Energy consumption and operation	TBD	TBD	Capital Budget
Retro-commissioning: Kerr Hall Saunders Hall Hooker Lab Memorial Hall	Energy consumption	TBD	$210,000	Energy Efficiency Reserve Funds
Multiple Retro-commissioning Assessments	Energy consumption	TBD	TBD	Budget Committee
Complete Lighting Surveys of all campus buildings	Electric consumption	TBD	$5,000	Budget Committee
Lighting Retrofits (T-12 to T-8/T-5): 8 buildings	Electric consumption	TBD	TBD	Budget Committee
Lighting Control Projects 3 Buildings	Electric consumption	TBD	TBD	Budget Committee
Pilot LED Projects: Wall Pak Replacement MR-16 replacements	Energy consumption	TBD	TBD	Operating Budget
HVAC Control Projects: 4 Buildings 20 Wireless TSTATs	Energy consumption	TBD	$500,000	Operating Budget and R+R funds
Building Shutdowns: Expand building setback/shutdown program	Energy Consumption	TBD	TBD	Operating Budget
Lab Energy Projects: 3 Buildings	Energy consumption	TBD	TBD	Operating Budget
Insulation: 1 Building	Energy consumption	TBD	TBD	Operating Budget

Economizer Projects: Campus Survey of potential sites	Energy consumption	TBD	TBD	Operating Budget
Renewable Energy Projects: Fetzer –Solar Hot water Chapman – PV Panels	Energy consumption	$8,759 / 45 year payback	$396,047	RESPC, if the committee elects to fund both projects

Energy Data Management

Past Year Accomplishments	Measurement	Annual Savings Actual/Anticipated	Cost	Funding Resource
Enterprise Building Management System	Energy savings	TBD	$3,672,600	Higher Education Bond
Strategic Demand Side Energy Study-Phase I	Planning for future projects	Targeted at 20% reduction by 2010 based on FY03 base year	$29,700	Budget Committee
Energy Display in Morrison residence hall	Energy savings	Will depend on student response to the energy display (est. 10%)	$46,515	SEO, RESPC and Housing
Installation of automated electric metering (partial)	Billing accuracy	TBD	$2,500,000	Capital Project Budget
Future Planned Activities				
Utility Tracking Software	Energy analysis	TBD	$100,000	Operating Budget
Strategic Demand Side Energy Plan – Phase II	Energy Consumption	Targeted at 20% reduction by 2010 based on FY03 base year	$200,000	Budget Committee and Operating Budget
Energy efficient lab equipment study	Energy Consumption	TBD	TBD	Operating Budget
Enterprise Building management System: Interval energy data BAS data	Energy Consumption	TBD	$410,000	Higher Education Bond
Energy consumption database	Energy analysis	TBD	$200,000	TBD

Energy Supply Management

Past Year Accomplishments	Measurement	Annual Savings Actual/Anticipated	Cost	Funding Resource
Replace steam tunnel and piping – Phase A	Capacity, Efficiency	TBD	$50,000,000	Capital Project budget
Cogen cooling tower replacement	Capacity, Efficiency	TBD	$10,800,000	Capital project budget
Replacement of gilsulate steam and hot water piping	Energy savings	TBD	$20,000,000	Capital Project budget
Two initial substations completed	System on-line	Increase / Improve system capacity for expected campus demand load	TBD	Capital Project Budget
Central facilities chilled water plant	Energy Savings/ Capacity	TBD June 2008	$1,500,000	Capital Project Budget
Future Planned Activities				
Replace steam tunnel and piping – Phase B	Capacity, Efficiency	TBD	$50,000,000	Capital Project Budget
Renovation of North Chiller Plant	Obsolescence, CFC removal, Efficiency	TBD	$34,000,000	Capital Project Budget
Final substation completed	System on-line	Increase / improve system capacity for expected campus demand load	TBD	Capital Project Budget
Initial 4 loop circuits functioning	Circuits connected and operating	Service reliability	TBD	Capital Project Budget
Substation Upgrades	Capacity; Reliability	TBD	$30,000,000	Capital project budget

SCADA / Fiber Optic systems completed	System on-line	Service reliability	TBD	Capital Project Budget
New electrical ductbanks and cabling	Capacity; Efficiency	TBD	$15,000,000	Capital Project budgetB

Water

Past Year Accomplishments	Measurement	Annual Savings Actual/Anticipated	Cost	Funding Resource
Installed dual flush valves on commodes in women's restrooms (57 buildings)	Water & Sewer savings	2,025,496 gallons $10,568 / yr 3.8 yr payback	$ 40,158	Operating Budget
Repaired hot underground hot water leak at Woolen Gym	Water savings	6,570,000 gallons if the leak had gone undetected for a year	TBD	Operating Budget
Chapman Hall – Replace water powered Aspirators	Water savings	TBD	TBD	Operating Budget
Metered or infrared faucets in 3 new buildings	Water & Sewer savings	812,994 gallons	$7,012	Capital Project Budget
Ultra low-flush urinals, O.5 gal per flush (2 buildings)	Water & Sewer savings	126,685 gallons	$1,092	Capital Project Budget
ITS Manning	Displaced storm water	TBD	TBD	Capital Project Budget
Hanes Hall Cistern	Water savings	150,000 gallons	$670	Capital Project Budget
Low-flow showerheads in new residence halls	Water & Sewer savings	TBD	TBD	Capital Project Budget
Dual flush toilets in public restrooms in all in new residence halls	Water & Sewer savings	TBD	TBD	Operating Budget
Front loading washing machines in residence halls	Water & Sewer savings	TBD	TBD	Operating Budget
Change Fire Pump Testing to Venturi Package, two out of every three years	Water savings	1,125,000 gallons	$5,651	Operating budget

Install dual flush valves on commodes in women's restrooms (20 buildings)	Water and sewer savings	TBD	TBD	Operating budget
Measure the savings from dual-flush toilet valves in a campus building	Water and sewer savings	TBD	TBD	Sloan Valve Co.
Investigate Sterilizer Trap Coolers	Water savings	TBD	TBD	Operating budget
Investigate Laser Cooling Water	Water savings	TBD	TBD	Operating budget
Assess Clean Steam Replacement Unit – MBRB	Water savings	TBD	TBD	Operating budget
Foundation Drain Water Recovery from Genetic Medicine Building for Cooling Tower Use	Water savings 3,700,000 gallons	TBD	$16,520	Operating budget

Water Additional Savings

2008 Additional Drought Modified Water Use (Temporary Savings)				
Minimize condensing generation at Cogeneration Facility	Water savings	7,000,000 gallons	$31,255	Operating Budget
Reduced test run time on Emergency Generators and Fire Pumps to 2 to 3 minutes	Water savings	40,000 gallons	$178	Operating Budget
Hand watering using non-potable water in tanks	Water savings	36,000 gallons	$160	Operating Budget
Delayed landscaping	TBD	TBD	TBD	Operating Budget
Irrigation reduction on landscape, discontinue spray irrigation	Water savings	12,000,000 gal/year	$53,580	Operating Budget
Athletics Irrigation reduction	Water savings	10,920,000 gal/year	$48,757	Operating Budget
Discontinue vehicle washing	Water savings	255,000 gal/year	$2,199	Operating Budget
Turn off decorative fountains	Water savings	168,000 gal/year	$750	Operating Budget
Discontinue Street and Sidewalk Cleaning	Water savings	10,000 gal/year	$45	Operating Budget
Discontinue Window Washing (approx. 130 buildings)	TBD	TBD	TBD	Operating Budget
Reduce Quarterly fire sprinkler testing to annual	Water savings	3,000 gal/year	$13	Operating Budget
Revise food waste processing at Dining Halls	Water and sewer savings	1,560,000 gal/year	$13,455	Operating Budget

Remove Dining Hall Trays	Water and sewer savings	279,000 gal/year	$2,406	Operating Budget
Cancel Parking Deck Power Washing	Water savings	TBD	TBD	Operating Budget
OWASA Reclaimed Wastewater in Cooling Towers	Water savings	210,000,000 gallons	TBD	Capital project Budget
Non-Potable Water System Integration of Stormwater Cistern Water with Reclaimed Water Back-up for Kenan Stadium Irrigation	Water Savings	1,885,160 gallons	TBD	Capital Project Budget

Energy Mandate

I have read the Strategic Energy & Water Plan for my Organization. The plan, as presented, supports the reductions required in Session Law 546.

Implemented this 23 day of September 2008.

Chris M. Martin Jr.
Director of Energy Management

Ray DuBose
Director of Energy Services

Van Dobson
Assistant Vice Chancellor for
Facilities Services

Carolyn Elfland
Associate Vice Chancellor for
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