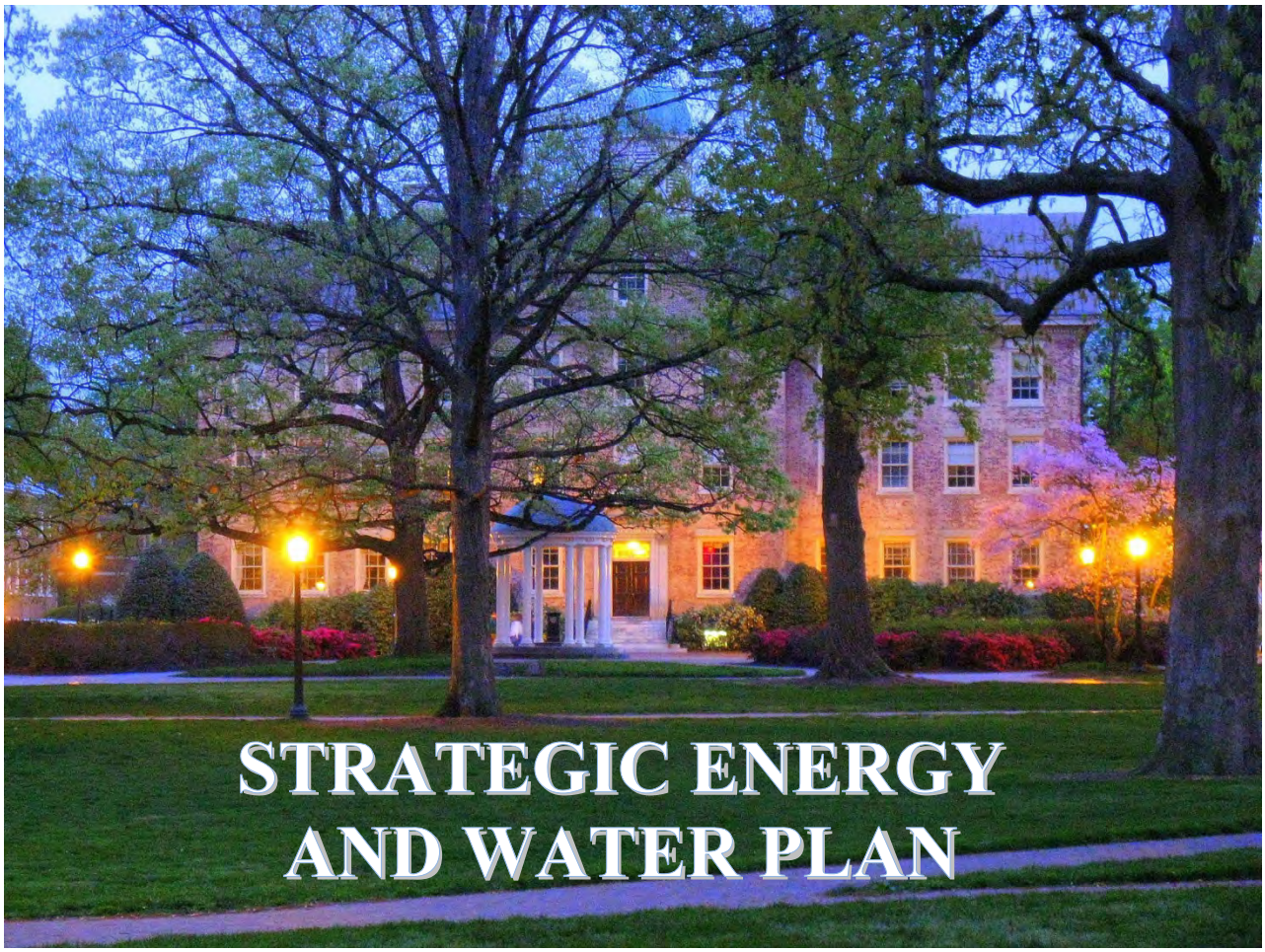
UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL



September 2009

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Executive Summary

The University of North Carolina at Chapel Hill (UNC) continues to place a priority on energy and water conservation with construction and renovation projects, existing building retro-commissioning, lighting upgrades and a commitment to pursue performance contracting.

UNC is beginning the process of selecting an energy services contractor (ESCO) in FY10 and will have a dedicated position in Energy Management to manage future performance contract(s).

A new project started in May, 2009 is a low cost/no cost energy conservation project geared toward fast implementation. Seven energy conservation measures were identified and the work is split into two phases. The first phase, which began in July, 2009, includes:

- raise air handler discharge air temperatures to 58° F
- implement occupancy schedules for buildings
- reduce minimum cooling airflow set points on VAV systems to thirty percent of maximum
- implement temperature standards of summer 76-78° F and winter 69-71° F
- enlist campus community to shut off unnecessary lights and equipment

The second phase includes:

- identifying and eliminating simultaneous heating and cooling in air handlers
- optimizing heat recovery loops and outside air economizers

The anticipated annual energy reduction is 28.9 MTon-hr chilled water, 180 Mlbs steam, and 6,000 MWh electrical, with an investment of approximately one hundred and fifty thousand dollars and fifty five hundred man-hours. These reductions will help offset our funding shortfall for utilities.

In April 2009, the first phase of the joint venture between UNC and Orange Water and Sewer Authority (OWASA) to provide reclaimed water to UNC's campus for non-potable needs was completed. The first phase serves the Tomkins, East and South Chiller Plants and saved approximately 27 Mgal of potable water for the partial year of operation. After completion of Phase 2 of the reclaimed water system in FY10, the projected savings by use of non-potable water is 218 Mgal annually.

The WateReuse Association selected UNC as the winner of the 2009 WateReuse Institution of the Year Award. The WateReuse Institution of the Year Award recognizes institutional projects whose significance and contributions to the community continue to advance the water reuse industry. UNC has demonstrated continued dedication to the water reuse community, and the WateReuse Association gratefully acknowledged the contributions we have made with our water recycling projects.

In FY10, UNC will complete two much awaited projects, the Enterprise Building Management System (EBMS) and our Strategic Demand Side Energy Plan (SDSEP). Both projects are in their final stages and completion is expected in the first half of the fiscal year.

Activities during Fiscal Year 2009

UNC completed the following projects which reduced energy and water consumption:

- 435,186 square feet of new construction meeting or exceeding the state's energy code and UNC's energy standards
- 207,782 square feet of renovated space meeting or exceeding the state's energy code and UNC's energy standards
- 51,889 square feet of existing space demolished
- Climate Action Plan was completed, the next step in meeting our ACUPCC commitment for greenhouse gas reduction
- The OWASA – UNC joint venture to provide reclaimed water to campus for non potable needs, completed its first phase and saved approximately 27 Mgal of potable water; after completion of Phase 2 of the reclaimed water system, the projected savings by use of non-potable water is 218 Mgal annually
- commissioning completed or in progress for 1.4 million square feet of building space
- retro-commissioned 469,000 square feet of building space
- lighting upgrades for 352,000 square feet of building space

UNC Energy Management teamed with UNC Sustainability to establish a new campus wide Energy Policy which educates campus on behavioral methods to reduce resource consumption, includes space management standards to improve efficiency and incorporates building occupancy schedules and space temperature standards to reduce energy consumption.

UNC Facilities Services updated our strategic plan with a focus on fifteen initiatives. One of those new initiatives is 'Energy Conservation'. A team of multi-departmental volunteers from Facilities Services and Energy Services assembled to complete this initiative by December, 2010 and seeks to:

> *"Develop and implement a method for making building level energy consumption transparent and meaningful to the UNC community. Develop and implement a program to educate the UNC community of ways to reduce the energy consumption on campus and to reward measurable energy savings."*

This initiative focuses on; providing 'dashboard' type building energy data, educating faculty, staff and students on how their actions can reduce resource consumption and providing incentives for successful resource reduction efforts.

As part of UNC's commitment to make resource conservation a campus wide endeavor, UNC Energy Management adopted an existing website, http://www.save-energy.unc.edu/, to provide information and news on conservation efforts.

The results of our energy conservation efforts for the last seven years are shown in Table 1. This data including auxiliaries 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, 2009. UNC Hospitals, Energy Services buildings, and separate agencies are not included in either consumption or gross square footage data. Energy Services' operating costs are included in the utility rates which are indirectly reflected in Table 1.

Table 1: Seven-Year Record of Progress in Energy Reduction

Year	Total Energy Costs	Total GSF	Energy Costs per GSF	Total MBTU	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	154,692	-7%
2007-08	$71,145,684	17,092,418*	$4.16	2,487,742	145,547	-12%
2008-09	$82,514,372	17,475,715	$4.72	2,673,778	153,000	-8%

*Building square footage was changed for 2007-2008 to remove buildings included in error.

Table 1 above shows the progress that was made in reducing energy consumption per square foot since 2003 by 8%. The BTU per GSF increased this past year due to the addition of several high energy intensity buildings. If these new buildings are removed from the total then the percent change in BTU per GSF was slightly better than last year at –13% (145,294 BTU per GSF).

Chart 1 shows that even as the total building square footage has increased the general trend of energy use per square foot is downward.

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

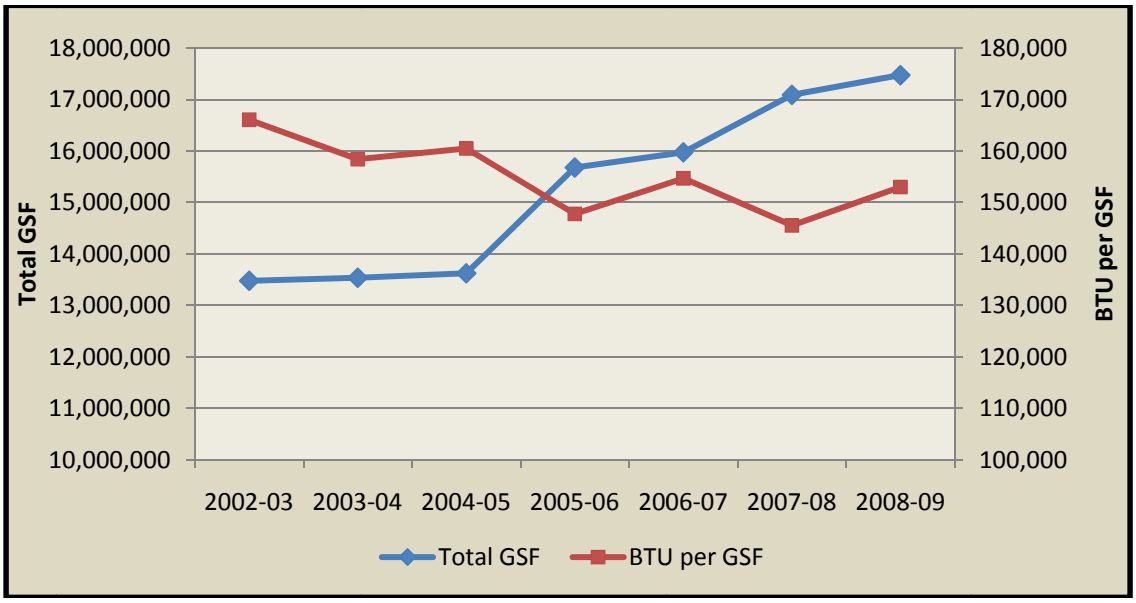
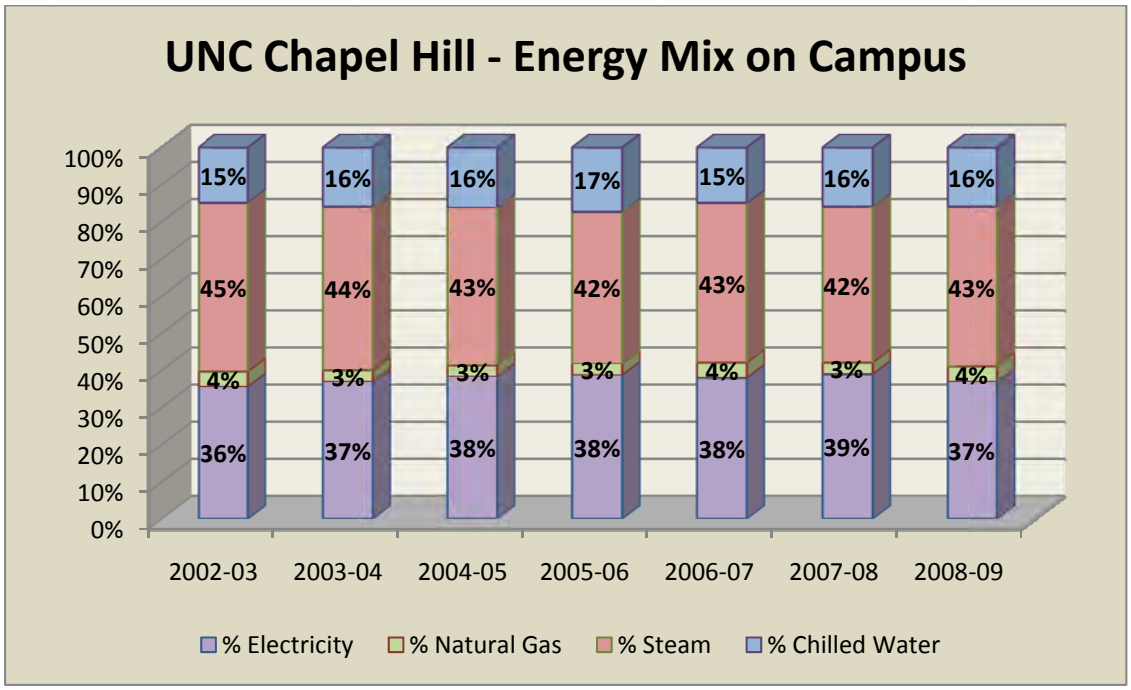


Chart 2 shows the University's energy consumption mix of electricity, natural gas, steam and chilled water since FY03. For FY09, steam was 43%, electricity 37%, chilled water 16% and natural gas was 4% of the total energy consumption. These percentages have remained fairly constant over time indicating that energy conservation has occurred approximately equally in all utility areas.

Chart 2: Energy Mix on Campus



Energy Supply

Energy Services

UNC Energy Services utilizes District Energy and Combined Heat and Power (CHP) Systems, which are a highly efficient, cost effective and environmentally responsible means of providing energy. UNC's three energy systems, Chilled Water, Cogeneration (steam), and Electric Distribution, are closely interrelated and operate together for optimal efficiency.

The primary purpose of Cogeneration Systems is to generate and distribute steam which is used for heating, humidification, domestic hot water, sterilization and making distilled water. During the cogeneration process, the steam passes through a steam turbine generator and can produce up to one-third of the electricity used on campus. Electric Distribution Systems purchases the additional power needed from the local utility provider, Duke Energy. The energy provided by both sources is delivered to UNC's three substations and distributed through an intricate and complex distribution system to all buildings and roadway, parking lot, and area lighting systems. Chilled Water Systems' five networked central chiller plants house either electric centrifugal chillers or steam absorption chillers. These plants produce the chilled water for campus cooling using different combinations of chillers, depending on the more cost effective energy source at the time.

Energy Services Water, Wastewater and Stormwater Systems provides the engineering management of the University's potable water and non-potable water supplies, stormwater system and wastewater collection systems; serves as the University's liaison to the local provider of public water and sewer services, Orange Water and Sewer Authority (OWASA); and works closely with other University departments and outside agencies in the management of the University's stormwater and non-potable programs, ensuring compliance with government regulations and permits

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

Cogeneration Systems

During the cogeneration process, the steam passes through a 32 MW double automatic controlled extraction pressure and condensing steam 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 technology called circulating fluidized bed (CFB). Continuous air emissions monitoring equipment ensures

compliance with all State and Federal air quality regulations and has been nationally recognized throughout the years for its accomplishments and environmental performance.

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.

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 January 14, 2009. The UNC facility produces 0.272 metric tons of carbon equivalents less than a typical separate heat and power facility. This is equivalent to planting 11,188 acres of forest or removing the emissions of 9,011 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. Biomass test burns are planned as soon as an adequate quantity of material is available.

One outgrowth of this study is a project 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 University complex on Airport Drive and for Carolina North as it develops.

Chilled Water Systems

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 rapid response to outages of either energy source, and managing costs by 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.

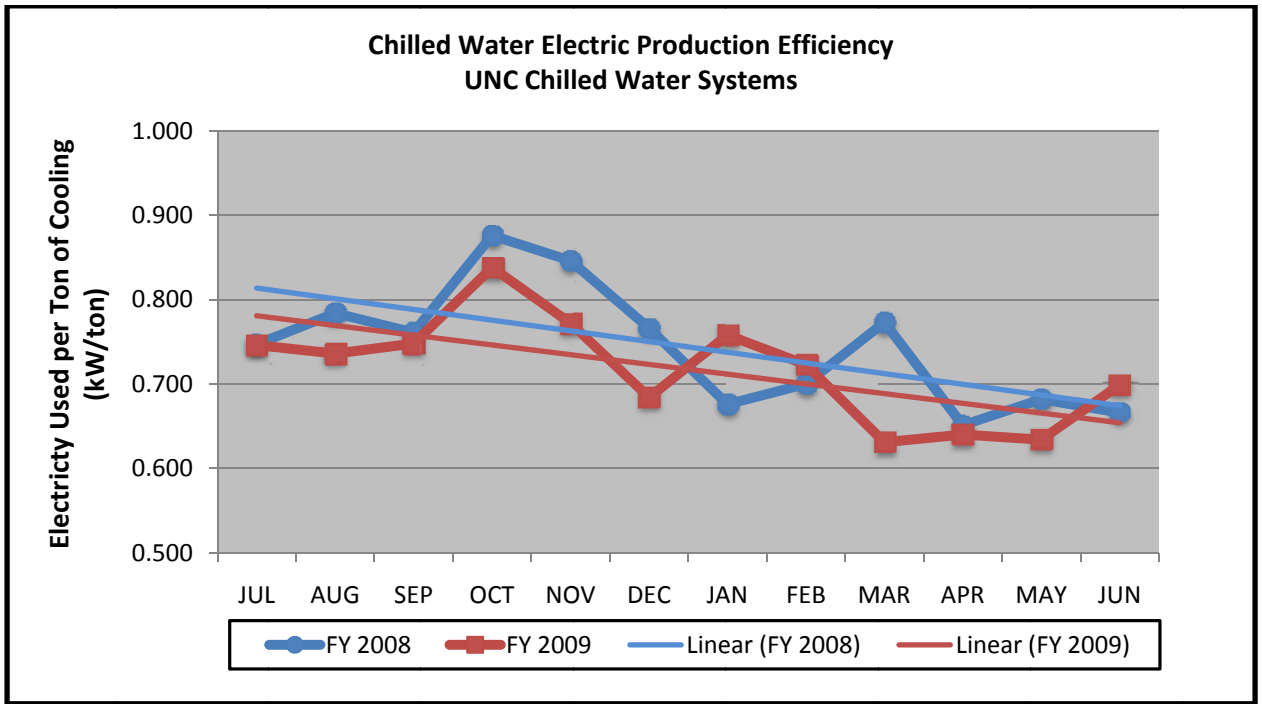
Chiller Plant Efficiency

Continued emphasis on operating efficiency has improved chilled water system efficiency by 7% since 2007. This represents an avoided production cost of $700,000 and an approximate carbon emissions reduction of 3,000 metric tons annually. Some specific measures taken to improve efficiency include:

- Seasonal adjustment of chiller plant supply temperatures. Instead of supplying 42° F supply temperatures year round, 47° F is supplied in the winter and 42° F in the summer. For every one degree increase in supply temperature, plant efficiency increases approximately 1.5%.
- Optimized wintertime condenser water flow rates and temperatures. When colder cooling tower water is available in winter condenser water temperatures are lowered to 55° F from 85° F, reducing the flow rates through the chillers. This results in winter chiller efficiencies that are up to 33% better than summer efficiencies.
- Three additional projects underway that will improve efficiency are as follows:
    - The renovation of the North Chiller Plant will provide upgrades including new chillers that will operate more efficiently than the older chillers being replaced.
    - A control system upgrade project will install a completely new Windows-based control system which will provide economies due to increase efficiency of operation of the chilled water system.
    - Installation of variable frequency drives on pumps in chiller plants projects are in the planning stages. These VFD's will reduce electrical demands from the pumps during partial load conditions with significant savings as a result.

Distribution Efficiency

The chilled water distribution pumps located in 75 buildings were placed in series with the central plant pumps. This allows the pressure provided by the central plant pumps to assist the building pumps with circulating chilled water through the buildings. This arrangement resulted in approximately 30% reduction in pump energy. These seventy-five buildings have a total of 2,700 installed pump horsepower.



Electric Distribution Systems

Electric Distribution Systems receives power from the local utility provider, Duke Energy, and the UNC 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. Energy Services has adopted a Smart Grid concept for its distribution system, has built infrastructure (1) for flexibility of generation source, whether from renewal or other traditional sources; (2) for reliability including redundancy of supplies to buildings through loop circuits and high speed sectionalizing switches; and (3) for automation of operation through its SCADA system, automated metering, and ongoing efforts to provide customers with real-time and historical energy consumption information.

System updates and expansion continues with the development and improvement of capacity and reliability at all three substations. The 100 kV transmission system from Duke Energy is being converted at each substation from air-insulated to gas-insulated switchgear. 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 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 to continuously monitor electric consumption to each building.

Renewable Energy

Solar Thermal

One of Energy Services' first renewable energy efforts involved restoring the Morrison Dorm solar panels to service. The panels had experienced several failures and their performance had not been fully quantified. The first step was to evaluate the building's energy usage and take low cost steps to reduce heating and cooling loads. Reprogramming and retuning the HVAC system yielded energy savings of approximately 50% in all primary utilities (chilled water, steam, and electric).

An evaluation of the solar panels was then conducted and it was determined that for much of the year, the panels were able to produce more heat than was required to make domestic hot water for the building. This imbalance was leading to underutilization of the system during periods of low occupancy and also to over-temperature failures of the panels and piping. To allow the solar collectors to serve more loads and protect them from over temperature, they were reconfigured to supply heat to both domestic hot water and the building heating system. These two loads are large enough year-round to use all available solar energy from the collectors.

As of June 6th, the solar panels are back in service. During the summer season, they have been able to provide all space and hot water heating needs. As the students return, additional steam will still be needed, but will only be used after all collected solar energy is used.

Solar PV

The new Visitor Education Center at the North Carolina Botanical Garden is the first solar PV installation on campus. The PV capacity is 15 kW. There are 84 panels of 180 W each, 4 rows of 21 each. Output voltage of the system is 120/208 V. That is the output of two inverters that

convert the PV cell DC power to AC. Protective devices are included in the circuitry from the PV cells to the Electric Distribution System (EDS), to prevent any energizing of EDS in the event any EDS service disconnects.

Landfill Gas

In 2009, UNC signed an agreement with Orange County to capture methane gas, which traps twenty times as much heat as carbon dioxide. At the Eubanks Road landfill in Chapel Hill, the methane gas produced during decomposition has long leaked into the atmosphere. During the first year, while a combustion facility is built, the gas will be flared to keep it out of the atmosphere. Starting in 2011, electricity generated by the methane will power nine campus buildings, including the Administrative, Energy Services and Facilities complexes. More buildings will be served by methane-produced electricity when the new Carolina North research campus is built.

Data Management

Energy Management is working in conjunction with Energy Services to present energy data to the campus on a dashboard display. This will provide the ability to monitor interval, monthly and annual utility consumption for steam, electricity, chilled water, domestic water and reclaimed water. 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.

The Enterprise Building Management System (EBMS) completed the integration of 131 building automation systems into a common framework for accessing and analyzing building energy and operations data. This will provide access to historical and current (real time) alarming, reporting, trending and scheduling for nearly 35,000 existing data points on campus.

Energy Services implemented a new web site that provides online monthly 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.

Organizational Integration

Teaching

By integrating issues of climate, energy, resource conservation, and environmental impact into the curriculum, Carolina is preparing students to take an active role in addressing these critical issues. Undergraduate students may focus their studies on specific areas related to energy and environmental impact with major concentrations in Environmental Studies, Environmental Science, Environmental Health Sciences, Marine Sciences, Biology, Material Sciences, Physics and Astronomy, and more. Alternatively, students can bring a sustainability lens to any academic concentration by enrolling in the new Sustainability minor introduced in 2008. Graduate students specialize in a range of areas, including nationally recognized programs in Environmental Sciences & Engineering, Sustainable Business Administration, City & Regional Planning, Ecology, Public Policy, Social Work, and more.

A recent inventory of individual courses at UNC identified more than 300 undergraduate and graduate courses related to sustainability. Classes offered were primarily in the College of Arts and Sciences, though several graduate and professional schools, including Business, Journalism and Mass Communications, Public Health, and Social Work have also introduced sustainability into their curriculum. Departments with multiple sustainability options include Anthropology, Communications, Geography, Geology, Marine Sciences, Pubic Policy, and Sociology.

Research

As a leading research university, Carolina has a wide range of programs that seek to better understand human-environment interactions, discover new materials and methods of renewable energy production, and better inform decision makers.

In 2008, the Solar Energy Research Center was launched by the Chemistry Department. In summer 2009, the Center became one of 46 Energy Frontier Research Centers (EFRCs) funded by the U.S. Department of Energy and American Recovery and Reinvestment Act. Research will focus on solar fuels catalysis, development of hybrid materials, organic photovoltaics, and advanced spectroscopy and theory. The Center is the only EFRC- funded center in North Carolina and one of 16 that received Recovery Act funds for job creation.

The Institute for Advanced Materials, Nanoscience and Technology (IAM) is a multidisciplinary research institute that brings together the physical sciences, emerging new sciences, and society to address complex problems in areas such as human health and energy. Research areas have included support of nanofluidic sensors, cancer research, bio-inspired materials, and the innovative design of fuel cell membranes.

The Center for Sustainable Energy, Environment and Economic Development explores energy issues facing the state, nation, and world. Researchers examine the rationale and consequences of various energy choices and the feasibility of alternative and nuclear energy sources.

At the School of Law, Distinguished Professor in Environmental Law Victor Flatt specializes in issues related to the administration of environmental statutes. His publications and findings have informed policy makers on carbon offsets and the impact of offsets on a carbon market. His research extends to the classroom, where students in the "Carbon Trading Practice" course examine the mechanisms and impacts of greenhouse gas trading systems.

Public Service & Engagement

By tapping academic expertise, applying research, and creating vital partnerships, the University becomes a resource for communities both near and far. In 2008, UNC was labeled a "College with a Conscience" by the Princeton Review for outstanding community involvement, and listed on the U.S. President's Higher Education Community Service Honor Roll with Distinction. The Public Service Scholars program, started in 2003, recognizes students who graduate with at least 300 hours of service and complete specific service-learning courses. Since the program's inception, more than 2,800 participating students have contributed almost 430,000 service hours. In 2009, UNC graduated 171 Public Service Scholars averaging 504 service hours per student – the highest average yet.

The Environmental Law Project, a student group at UNC's School of Law, is working with the town of Chapel Hill to develop a program to weatherize low-income housing units in the community. These students have helped weigh the costs and benefits of different contracting and funding models, and identified tools which the Town can use to manage the financing.

The Business Accelerator for Sustainable Entrepreneurship (BASE) in the Kenan-Flagler Business School is the first incubator in North Carolina to specifically support businesses pursuing the triple bottom line of social equity, ecological integrity and financial profitability. In 2009, 20 entrepreneurs were selected to participate, representing a wide range of innovators. Business concepts include portable, affordable, simple-to-operate systems to power irrigation pumps in remote regions of developing countries; increasing the supply of high-quality, local organic produce to regional and national buyers; selling rainwater-harvesting equipment; and more.

In 2008, a UNC task force came together to conduct and present a study for local leaders on the feasibility of building a "green" industrial park in Camden County, North Carolina. Funded by the Golden LEAF Foundation, this project brought together the Institute for the Environment's Center for Sustainable Community Design, the Environmental Resource Program, the Kenan-Flagler Business School's Center for Competitive Economies, and the School of Government's Environmental Finance Center. The group worked with the local community to assess perspectives and opportunities for the industrial park. Since the final report, the UNC group leader continues to consult with local leaders as they move forward with planning.

The Institute for the Environment's Environmental Resource Program (ERP) focuses on increased awareness of the role of individual actions in achieving community sustainability.

Recent activities have included:

- Engaging with K-12 teachers and students statewide to raise awareness about the impact of carbon dioxide emissions through presentations and workshops
- Partnering with the UNC Morehead Planetarium and Science Center in summer 2009 to sponsor the first Climate Leadership and Energy Awareness Program (Climate LEAP), a two week-long summer science institute followed by school-year activities for 48 local high school students

Campus Outreach

Awareness of and support for sustainable programs and practices on campus has increased dramatically over the past few years. The boost in campus-wide interest can be seen most clearly in the increased number of University publications exploring issues of climate change, energy and water conservation, and sustainability. In 2009, the Daily Tar Heel newspaper ran a series of articles documenting the ground-breaking environmental research done across campus. The Division of Student Affairs' Carolina Family magazine, sent to the parents of students, focused its spring 2009 issue on campus sustainability with features on operations, academics, research, engagement, and campus life. Similarly, the Carolina Alumni Review, sent to General Alumni Association members, profiled campus sustainability efforts in its July/August 2009 feature, "Being Carolina Green."

The Sustainability Office made a concerted effort to communicate the results of its sustainable infrastructure initiatives to campus members and visitors, both real and virtual, in keeping with the University's UNC Tomorrow commitment. The Sustainability website now offers interactive Google Maps of sustainable campus features, a printable walking tour, online videos, and a daily blog. The Sustainability listserv, which receives regular email updates of campus news and events, now has more than 800 subscribers. Supporters of UNC Sustainability on Facebook now also can stay connected.

The Carolina Green website is a new portal that connects to all things green at Carolina, including zero waste events, campus departments, courses and programs.

The Institute for the Environment website includes up-to-date and comprehensive lists of environmental faculty, news and events. At Campus Sustainability Day 2008, the Institute for the Environment launched a local group on the national MakeMeSustainable website. This online social networking tool enables people living in Chapel Hill and Carrboro to track and reduce their carbon dioxide emissions. In the first 6 months, more than 125 people joined this online community from the Chapel Hill and Carrboro area, and, in turn, invited another approximately 150 people to join. In total, the Chapel Hill/Carrboro "carbon tree" has over 280 members who have reduced their annual emissions by over 70 tons.

In February 2009, the Institute for the Environment and the UNC School of Journalism and Mass Communication introduced a TV and poster campaign to encourage cold water use in campus laundry facilities to conserve energy. The public service announcement, shown during a cable news program and posted online, has been viewed more than 1,300 times.

Launched in 2007, a new stormwater management website and staff training program developed by the Environment, Health, and Safety Department makes Carolina's practices and accomplishments accessible to a wider audience. The curriculum communicates the importance of stormwater management, clarifies the roles of different departments, and provides resources for planners, project managers, and construction/maintenance staff. Since inception, more than 630 campus members participated in this training.

In conjunction with OWASA, UNC's Energy Services Water, Wastewater and Stormwater Systems provided staff training on reclaimed water to UNC's Chilled Water Systems, Grounds, Athletics and Plumbing Shop. Public education on reclaimed water and was also provided to the campus community.

Water Resources Management

Potable Water

UNC is developing an integrated Non-Potable Water System that supplies non-potable water for approved non-potable uses thereby reducing the use of potable water. Non-potable water uses include cooling tower make-up water, toilet flushing, and irrigation. Sources of non-potable water used at the University are reclaimed water, rainwater, and condensate.

Table 2 below, Seven-Year Record of Progress in Potable Water Usage Reduction, includes campus water consumption and water consumption for Energy Services. Energy Services' water consumption is for the production of chilled water and cogeneration of steam and electricity serving the campus community.

Table 2: Seven-Year Record of Progress in Potable Water Usage Reduction

Year	Total Water Usage (Gallons)	Total GSF	Water Usage Gal per GSF	% Change in Usage per GSF Relative to Previous Year	% Change in Usage per GSF Relative to Baseline 2002-03
2002-03	666,812,000	13,477,719	49.48		
2003-04	659,382,000	13,537,153	48.71	-2%	-2%
2004-05	632,909,000	13,623,133	46.46	-5%	-6%
2005-06	681,288,000	15,680,862	43.45	-6%	-12%
2006-07	670,094,000	15,974,743	41.90	-4%	-15%
2007-08	675,445,000	17,092,418*	39.50	-6%	-20%
2008-09	631,471,000	17,475,715	36.13	-9%	-27%

***** Building square footage was changed for 2007-2008 to remove buildings included in error.

Non-Potable Water

UNC has partnered with Orange Water and Sewer Authority (OWASA) on a reclaimed water system to supply the campus. Reclaimed water is highly treated wastewater that is regulated by the NC Division of Water Quality. Reclaimed water from OWASA's Mason Farm Wastewater Treatment Plant would be discharged to Morgan Creek, but instead receives chlorine treatment in addition to the UV disinfection and is pumped to UNC.

Reclaimed water usage started in spring of 2009. Total reclaimed water usage for FY09 was 27 Mgals. The first chilled water plants to use reclaimed water were Tomkins, South and East Chiller Plants. Upcoming uses of reclaimed water include Cobb Chiller Plant, North Chiller Plant, UNC Hospitals' Chiller Plants, toilet flushing at NC Botanical Gardens and future Genomic Science Building, irrigation of landscaping and irrigation of athletic fields on main campus and the softball complex near General Administration.

The first phase of the joint OWASA - UNC reclaimed water system installed 17,200 feet of reclaimed water pipe by several projects in 2004–2009. Part of this work was done by contract with OWASA, while funded by UNC. The OWASA installed work included a 600,000 gallon storage tank, associated treatment and pumping facilities, and reclaimed water main from the OWASA wastewater treatment plan to connect with the piping installed on the UNC campus.

The second phase is under construction and will extend the reclaimed water system to the Cobb Chiller plant, the Hooker Field cistern, Anderson Softball Stadium and Williams Softball Field, and Boshamer Stadium. The Hooker Field cistern provides non-potable water to Fetzer Field and Navy Field. Those field were previously served with harvested rainwater backed up by potable water, but now will be backed up by reclaimed water.

Fed-Ex Global Education currently uses non-potable water from the rainwater cistern for toilet flushing. Existing cisterns at Rams Head Plaza, Hanes Hall, and Hooker Field collect rainwater for irrigation uses.

The WateReuse Association selected UNC as the winner of the 2009 WateReuse Institution of the Year Award. The WateReuse Institution of the Year Award recognizes institutional projects whose significance and contributions to the community continue to advance the water reuse industry. UNC has demonstrated continued dedication to the water reuse community, and the WateReuse Association gratefully acknowledged the contributions we have made with our water recycling projects.

APPENDIX

Energy Use in Facilities

Past 12 Months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Resource
Commissioning 10 campus buildings: 1.4M GSF FY09	Energy consumption and operation		$172k		$825K		Energy Management	Misc capital project budget
Functional Testing: Genetic Medicine, Kenan Music Center	Energy consumption and operation		$67k		$323K		Energy Management	Misc capital project budget
Warranty Commissioning: Sitterson Addition, Physician's Office Bldg	Energy consumption and operation		$50k		$242K		Energy Management	Misc capital project budget
Retro-commissioning: Kerr Hall, Hooker Lab, Saunders Hall	Energy consumption		$44k		$210K		Energy Management	Energy Efficiency Reserve Funds
Retro-commissioning: Van Hecke Hall, Memorial Hall	Energy consumption		$18k		$86K		Energy Management	Operating budget
Retro-commissioning Assessments 5 buildings: 430K GSF	Energy consumption		Future Planning		$60K		Energy Management	Operating budget
Lighting Retrofits (T-12 to T-8) 6 buildings: 352K GSF	Energy consumption and operation		$51K		$211K		Energy Management	Operating budget
Lighting Control Projects: Knapp Sanders, ITS Manning	Energy consumption		$1K		$7K		Energy Management	Operating budget
Pilot LED Projects: Mary Ellen Jones, MBRB Lab	Energy consumption and operation		$1K		$3K		Energy Management	Operating budget

Lab Airflow Reduction Projects: 4 Buildings: 637K GSF	Energy consumption and operation		$93K		$489K		Facilities Services	Operating budget
Heat Reclaim system improvements: McGavran-Greenberg, Hooker Lab	Energy consumption		$8,445 for (McGavran Greenberg)		$53K		Facilities Services	Operating budget
BAS Standards Update and Training: Campus wide	Operational efficiency		N/A		$20K		Energy Management	Operating budget
Campus Energy Policy: campus wide	Energy consumption		Will depend on compliance		Salary		Energy Management and Sustainability	Operating budget
Fault Detection and Diagnostics Software: Global Education, Genetic Medicine	Energy consumption		TBD		$27K		Energy Management	Operating budget
New BAS controls for AHUs: Fordham Hall, Hill Building	Energy consumption		TBD		$169K		Energy Management	R&R budget Operating budget
New AHUs: 5 Buildings: 217K GSF	Energy consumption		TBD		$1M		Facilities Services	R&R budget
Economizer survey: Campus wide	Energy consumption		Future planning		$5K		Facilities Services	Operating budget
Energy Display: Morrison Residence Hall	Energy consumption		TBD		$18K		Housing	State Energy Office, UNC Housing
Renewable Energy Projects: Fetzer Gym –Solar water heating Chapman Hall – PV panels	Energy consumption		Design only		$27K		Energy Management	Student Funded

Future Planned Activities								
Activities	**Measurement**		**Savings**		**Cost**	**Jobs**	**Assigned to**	**Funding Resource**
	Expected	**Actual**	**Expected**	**Actual**				
Commissioning Projects 10 buildings: 1.4M GSF FY10	Energy consumption and operation		$172k		$825K	8,250hr	Facilities Planning and Construction	Capital Budget
Completion of one Retro-commissioning: Van Hecke Hall	Energy consumption		$75k		$50K	500hr	Energy Management	Unfunded
Immediate Energy Savings Program 138 Buildings: 15M GSF	Energy Consumption		$4.8M		$150K	1000hr	Energy Management	Operating budget
Response to issues uncovered in the Immediate Energy Savings Program	Energy consumption		TBD		$8K	7.5K per bldg	Building Services	Unfunded
Response to 5 FY09 Retro-commissioning Assessments	Energy consumption		TBD		$285K	1,425hr	Energy Management	Unfunded
BAS Standards Update: Campus wide	Operational efficiency		N/A		$8K	$8K	Energy Management	Operating budget
Lighting Retrofits (T-12 to T-8/T-5): Coker Hall	Energy consumption		$4K		$19K	Internal	Energy Management	Operating budget
Lab Energy Assessment Project: Neurosciences Lab	Energy consumption		Future Planning		$23K	230hr	Energy Management	Operating budget
Lab Airflow Reduction: Thurston Bowles	Energy consumption		$122K		$306K	1,530hr	Energy Management	Unfunded
Replace low efficiency motors	Energy consumption		$6K		$20K	Internal	Energy Management	Unfunded
5 Retro-commissioning Assessments	Energy consumption		Future planning		$60K	540hr	Energy Management	Operating budget

Six interns for AASHE STARS assessment	N/A		N/A		$9K	900hr	Sustainability	Unfunded
Lab Building Controls Optimization; Burnett-Womack Building	Energy consumption		$165K		$333K	2,500hr	Energy Management	Unfunded
Implement Behavioral Education Program	Energy consumption		$12K		$150K	6,240hr	Energy Management	Operating budget
Summer Intern Program	N/A		Support staff		$10K	258hr	Energy Management	Unfunded
Install new AHU: Jackson Hall	Energy consumption		TBD		$125K	580hr	Facilities Design and Construction	R&R budget
70 Retro-commissioning Assessments	Energy consumption		Future planning		$840K	7,560hr	Energy Management	Unfunded
Lighting Retrofits (T-12 to T-8/T-5): 28 buildings: 1.3M GSF	Energy consumption		$193K		$963K	Internal	Energy Management	Unfunded
Occupancy Sensor Projects: 2 buildings	Energy consumption		$5K		$15K	Internal	Energy Management	Unfunded
MR-16 LED Lamp Replacements	Energy consumption		$1K		$10K	Internal	Energy Management	Unfunded
Assessment of campus HW system	Energy consumption		Future planning		$5K	$5K	Energy Management	Unfunded
High efficiency transformers: 6 buildings	Energy consumption		$133K		$265K	Internal	Energy Management	Unfunded
HVAC Controls upgrade: 6 buildings	Energy consumption		TBD		$2.7M	12,841hr	Energy Management	Unfunded
HVAC VFDs: 5 buildings	Energy consumption		$103K		$516K	Internal	Energy Management	Unfunded

HVAC Tune-ups technical support for 10 buildings	Energy consumption		$16K		$16K	160hr	Energy Management	Unfunded
HVAC Retro-commissioning: 12 buildings	Energy consumption		$208K		$1M	7,800hr	Energy Management	Unfunded
Insulation: Attic and Walls 5 additional buildings	Energy Consumption		$26K		$154K	1,500hr	Energy Management	Unfunded
LED Projects: 1,000 Wall Pak Replacement	Energy consumption		$80K		$800K	Internal	Energy Management	Unfunded
Fume Hood Sash Closer: Hooker Lab	Energy consumption		$6K		$6K	40hr	Energy Management	Unfunded
HVAC Equipment Replacement: 22 buildings	Energy Consumption		$275K		$2.7M	21k hr	Energy Management	Unfunded
Window Replacement: 53 buildings	Energy Consumption		$3M		$30M	180,000hr	Energy Management	Unfunded

Energy Data Management

Past 12 Months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Resource
Enterprise Building Management System	Energy savings		Operational Improvements		$3.6M		Energy Management	Higher Education Bond
Strategic Demand Side Energy Study- Phases II and III	Planning for future projects		Targeted at 20% reduction by 2010 based on FY03 base year		$150K		Energy Management	Operating Budget
Future Planned Activities								
Next 12 Months Activities	**Measurement Expected**	**Measurement Actual**	**Savings Expected**	**Savings Actual**	**Cost**	**Jobs**	**Assigned to**	**Funding Resource**
Complete Enterprise Building Management System	Energy savings		Operational Improvements		$3.6M		Energy Management	Higher Education Bond
Complete Strategic Demand Side Energy Study- Phases II and III	Planning for future projects		Targeted at 20% reduction by 2010 based on FY03 base year		$150K		Energy Management	Operating Budget
Utility Tracking Software	Energy analysis		N/A		$50K	40hr	Energy Management	Unfunded
Energy Data Sharing (Dashboards)	Energy analysis		Future planning		$150K	1,350hr	Energy Services	Operating budget

Energy Supply Management

Past 12 Months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Resource
Replace steam tunnel and piping – Pkg 2	Capacity, Efficiency		TBD		$19M	200	Cogeneration Systems	Capital project budget
Upgrade of Manning and Cameron substations	System online		Increase / Improve system capacity for expected campus demand load		TBD		Electric Distribution Systems	Capital project budget
New electrical ductbank and cabling Phase II	Capacity; Efficiency		TBD		$6M	65	Electric Distribution Systems	Capital project budget
Future Planned Activities								
Next 12 Months Activities	**Measurement Expected**	**Measurement Actual**	**Savings Expected**	**Savings Actual**	**Cost**	**Jobs**	**Assigned to**	**Funding Resource**
Replace steam tunnel and piping – PKG 3	Capacity, Efficiency		TBD		$30M	326	Cogeneration Systems	Capital project budget
North Chiller Plant renovation	Obsolescence, CFC removal, Efficiency		TBD		$34M	370	Chilled Water Systems	Capital project budget
South substation upgrades	Capacity; Reliability		TBD		TBD		Electric Distribution Systems	Capital project budget
SCADA / Fiber Optic systems	System on-line		Service Reliability		TBD		Electric Distribution Systems	Capital project budget
Landfill Gas project	Renewable energy		TBD		TBD		Cogeneration Systems	Capital project budget
SCADA replacement for Chilled Water	Reliability and Updating		TBD		TBD		Chilled Water Systems	Capital project budget

Water

Past 12 Months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Resource
Reclaimed Water Phase I for cooling towers at Tomkins, South and East Chiller plants	Potable, domestic water savings	Potable, domestic water savings	210 Mgal $975K	27 Mgal (partial year)	$10M	107	Energy Services	Capital project budget
Boshamer Stadium Cistern Installed	Potable, domestic water savings			12 mgals	TBD		Energy Services	Capital Project
Installed 171 dual flush valves on commodes in women's restrooms	Water & Sewer savings		373 mgal $3K/ yr		$8K		Facilities Services	Operating budget Housing Support
Installed 155 low flow showerheads	Water & Sewer savings		4 mgal $30K		$2K		Facilities Services	Operating budget
Installed 49 0.125gpf urinals	Water & Sewer savings		112 mgal $876		$2K		Facilities Services	Operating budget
Foundation drain water recovery from Genetic Medicine building for cooling tower use.	Water savings		4 mgal $17K		$16K			Operating budget
Future Planned Activities								
Next 12 Months Activities	**Measurement Expected**	**Measurement Actual**	**Savings Expected**	**Savings Actual**	**Cost**	**Jobs**	**Assigned to**	**Funding Resource**
Install dual flush valves on commodes in women's restrooms (20 buildings)	Water and sewer savings		$2K		$6K		Energy Management	Unfunded
Irrigation control for reclaimed water at Tomkins	Water consumption		TBD		$5k		Grounds	Unfunded
Totten Garden Center: Reclaimed water and cistern	Water savings		TBD		$75K		Facilities Planning and Construction	Capital budget

Measure the savings from dual-flush toilet valves in one campus building	Water and sewer savings		TBD		TBD		Energy Management	Unfunded
Investigate Sterilizer Trap Coolers	Water savings		TBD		TBD		Energy Management	Unfunded
Investigate Laser Cooling Water	Water savings		TBD		TBD		Energy Management	Unfunded
Assess Clean Steam Replacement Unit – MBRB	Water savings		TBD		TBD		Energy Management	Unfunded
Investigate replacing domestic water cooled ice machines at Alumni Center	Water savings		TBD		TBD		Energy Management	Unfunded
Summer Intern Water Meter Auditing	Water savings		Support staff		$10K	258hr	Energy Management	Unfunded
Reclaimed Water, Phase 2 in Cobb Chiller Towers, Irrigation and NC Bot Garden Toilet Flushing	Water savings		24 Mgals (partial year)/ future full year: 64 Mgals		$2M		Energy Services	Capital project budget
Non-Potable Water System Integration of Stormwater Cistern Water with Reclaimed Water Back-up for Kenan Stadium Irrigation	Water Savings		1.8 Mgals		TBD		Energy Services	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 29th day of September, 2009.

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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