An aerial photograph of the NC State University campus. The image shows a mix of brick and modern buildings, green lawns, and a central intersection with a tall, white, obelisk-like monument. A red banner is overlaid at the top center of the image.

**NC STATE
UNIVERSITY**

STRATEGIC ENERGY AND WATER ANNUAL REPORT

FISCAL YEAR 2014

Prepared by NC State Energy Management for NC DENR - Utility Savings Initiative

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A Letter from the Director

For more than a decade, NC State's energy management efforts have helped the university conserve vital fiscal and environmental resources. This year is no different.

We are proud to report that compared to baseline campus energy use per gross square foot is down by 29% and water use is 46% less. This accomplishment, plus our successful promotion of energy and water saving principles on campus, helped the university earn the North Carolina Department of Environment and Natural Resources' Utilities Savings Initiative Leadership Certificate in April 2014.

This year's progress propels NC State toward surpassing both state-mandated energy and water conservation goals outlined in Senate Bill 668 and Session Law 2007-546: reducing energy use by 30% (as compared to the 2002-2003 baseline) and water use by 20% (as compared to the 2001-2002 baseline). We celebrate having accomplished the water conservation goal back in 2005 and having the energy goal within reach.

As you will discover in this report, our award-winning energy and water management efforts are as innovative and far-reaching as the university population we serve. From cutting-edge conservation projects to ever-improving campus data collection and management, we implement energy management best practices that help create a leaner, smarter, stronger NC State.

Alan Daeke
Director, Utilities and Engineering Services

Executive Summary

NC State has reduced campus energy consumption for five consecutive years with its 30% goal well within reach. Campus water consumption has remained relatively constant over the last five years. This year's consumption highlights follow.

- Compared to the FY 2002-03 baseline, total energy consumption per gross square foot (GSF) decreased by 29% (see Figure 1).

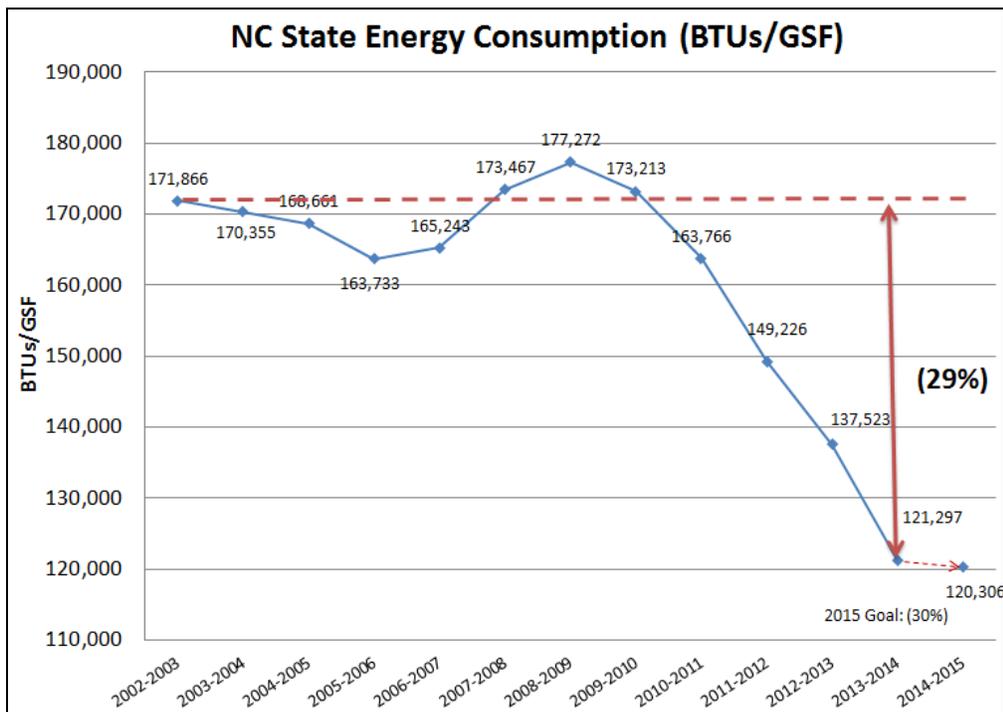


Figure 1-Energy Consumption per GSF

- Water consumption is 46% lower than the FY 2001-02 baseline (see Figure 2).

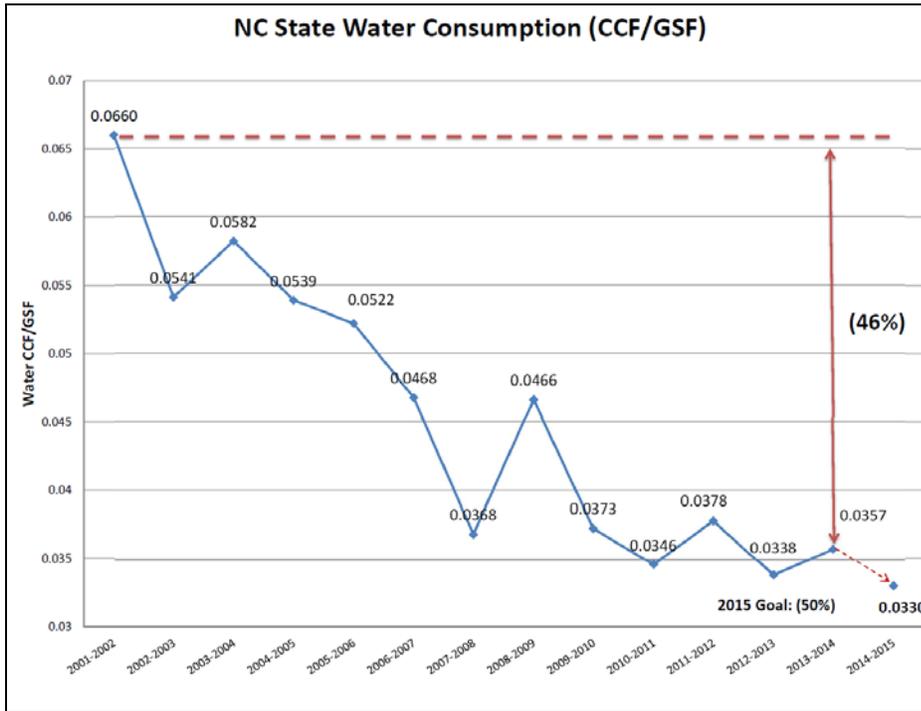


Figure 2-Water Consumption per GSF

- Utility consumption per GSF has steadily decreased since FY 2009-2010. After multiple years of reduction, this year's utility cost per GSF increased by 7% when compared to last year (see Figure 3). This increase is linked to multiple occasions of natural gas curtailment during the winter. During the curtailment period, NC State had to purchase fuel oil as an alternative to natural gas. The price of fuel oil is much more expensive per unit than natural gas and the impact may be observed in the utility costs per GSF increase.

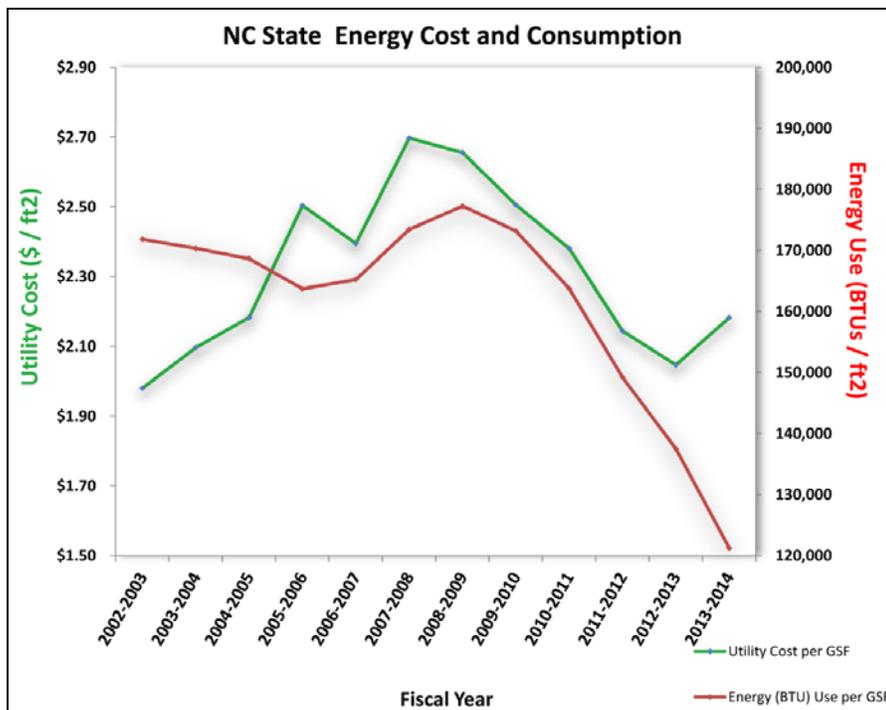


Figure 3-Energy Consumption and Utility Cost per GSF

The continued implementation of the university's *Climate Action Plan*, *Strategic Energy Management Plan*, and *Strategic Sustainability Plan* will ensure that NC State meets the FY 2015 energy and water reduction goals.

Abbreviations and Definitions

Abbreviations

| | | | |
|-------------|---|--------------|---|
| BAS | Building Automation System | GSF | Gross Square Foot |
| BMO | NC State Building Maintenance and Operations | HVAC | Heating, Ventilation, and Air Conditioning |
| BTU | British Thermal Units | KPI..... | Key Performance Indicator |
| CEST..... | NC State Campus Environmental Sustainability Team | kWh..... | Kilowatt Hour |
| CHP | Combined Heat and Power | LDC | Local Utility Distribution Company |
| CPM | NC State Capital Project Management | M&V | Measurement and Verification |
| DDC..... | Direct Digital Controls | MW | Megawatt |
| DSM/EE..... | Demand Side Management/Energy Efficiency Program | MMBTU | One Million BTU |
| EBS..... | eDNA Billing System | PSNC..... | Public Service Company of North Carolina |
| ECM | Energy Conservation Measure | RFQ | Request for Quote |
| eDNA..... | Extended Distributed Network Architecture | SCADA | Supervisory Control and Data Acquisition |
| EM..... | NC State Energy Management | TES..... | Thermal Energy Storage |
| EPC..... | Energy Performance Contract | TOU..... | Time of Use |
| FTE | Full Time Equivalent | UE | NC State Utilities and Engineering Services |
| GHG..... | Greenhouse Gas | UH | University Housing |
| | | UNC | University of North Carolina |
| | | UNC-GA | University of North Carolina General Administration |
| | | USO | NC State University Sustainability Office |

Definitions

| | |
|------------|--|
| BTU | British Thermal Unit; a unit of heat equal to the amount of heat required to raise one pound of water one degree Fahrenheit at one atmosphere pressure; equivalent to 251.997 calories. |
| CCF..... | Measure of Volume, 100 cubic feet = 1CCF = 748.05 gallons, 1 CCF of natural gas produces slightly more than 1 therm or 100,000 BTUs of energy. |
| CHW..... | Chilled Water Utility; used as a medium for transfer of heat away from the building. Chilled Water use is measured in millions of BTUs, 1 MMBTU = 1 decatherm. |
| DD | Degree Days; a unit of measure equal to a difference of one degree between the mean outdoor temperature on a certain day and a reference temperature (65° F). This term is used to estimate the energy for heating and cooling a building. Source: State Climate Office. |
| DDC..... | Direct Digital Controls; used in Building Control Systems for self-adjusting response to conditions based on preset programs tuned to the building. |
| Gal | Measure of volume, gallon(s), 1 gallon of water weighs 8.3453 pounds. |
| GHG..... | Gases that trap heat in the atmosphere are greenhouse gases. |
| GSF..... | Gross Square Foot; total building square footage, including parking decks, for which utilities are supplied. Source: AERES – Architectural Engineering and Real Estate System. |
| kW | Kilowatt ; a measure of power required at any moment to operate electrical devices. |
| kWh | Kilowatt-hour ; a cumulative measure of total electric energy, 1 kWh = 3,413 BTUs. |
| MMBTU..... | Measure of energy, 1,000,000 BTUs = 1 MMBTU. |
| MW | Measure of energy, MW=1,000 watts. |
| N/A | Not applicable, direct savings from these tasks is not quantifiable. |
| N/E..... | Not estimated, direct savings from these tasks is quantifiable but not estimated due to insufficient supporting data. |
| Therm..... | Measure of energy, usually in reference to natural gas, 1 Therm = 100,000 BTUs. |
| TBD | To be determined. |

Introduction

Mission

Energy Management's mission is to manage energy resources purchased and consumed by NC State in the most cost-effective manner possible, while supporting the complex needs of a research intensive campus. It is Energy Management's (EM) responsibility, together with the University Sustainability Office (USO), to promote energy conservation and awareness through the *Change Your State* education and outreach campaign and by continually engaging students, faculty, and staff at every opportunity.

Vision

The deployment of existing energy-efficient and renewable energy technology is the near-term and lowest cost option for managing campus demand for energy, especially through the next decade. Generally, the potential energy savings available from the accelerated deployment of existing energy-efficient technologies in buildings, transportation, and industry could more than offset projected increases in energy consumption through 2030. Accelerated deployment of these technologies could reduce projected energy use by approximately 20%.

National awareness of greenhouse gas (GHG) emissions, most notably carbon emissions, has prompted NC State to re-evaluate its future energy supply by creating an increased demand for renewable and carbon neutral energy solutions when practical. The future depends on renewable energy, expansion and modernization of the nation's energy infrastructure, and the ability to control energy demand for efficient use of the power grid. All of these elements will work in tandem to provide a sustainable energy future and a potential decrease in GHG emissions.

The widespread implementation of energy-efficient and renewable technologies will also create substantial reductions in GHG emissions. NC State understands the potential impact of its energy consumption to the environment and is committed to emission reductions through the creation of a campus *Greenhouse Gas Inventory* and *Climate Action Plan*. NC State's second *Greenhouse Gas Inventory* published in 2012, reported a 7% drop in the university's GHG emissions from 2008 to 2010. The *Climate Action Plan* projects a 20% GHG reduction from 2008 emissions by 2015. The focus leading up to 2015 will be on energy efficiency and fuel mix/renewables. The ultimate goal is for NC State to be carbon neutral by 2050.

Energy Management

A definition of energy management is the sum of measures planned and implemented to achieve the objective of minimizing energy usage. At NC State, the purpose of energy management is to reduce energy and water costs and consumption on campus consistent with the needs for a safe, secure, and inviting campus community.

Energy Management at NC State University is charged with energy supply and demand side management on campus (see Figure 4).



Figure 4- Energy Management Staff at NC State

Goals

In April 2011 NC State published its strategic sustainability plan entitled *Foundation for Advancing Sustainability: A Strategic Plan for NC State University*. The Plan lists seven strategic energy and water conservation goals as follows:

- Achieve a 30% reduction in building energy consumption by 2015 against the 2003 baseline.
- Achieve a 50% reduction in building water consumption by 2015 against the 2002 baseline.
- Improve energy data management capabilities and make data-driven decisions utilizing enhanced energy data.
- Train and educate staff and building end-users to properly operate and maintain building systems in an energy-efficient manner.

- Ensure a cost-effective and reliable energy supply by developing business scenarios and strategies for diversifying fuel sources.
- Evaluate utility financial structures that create incentives for saving energy.
- Implement green standards and practices for information technology and computing.

Metrics

During the course of each fiscal year, Energy Management monitors, tracks, and trends energy performance in facilities. Along with traditional key performance indicators (KPIs) including, Cost per Gross Square Foot (GSF), British Thermal Units (BTUs) per GSF, and Consumption per GSF, several additional KPIs are tracked such as, Energy Consumption per 1,000 GSF per Degree Day (DD), Utility Cost per Student, One million BTUs (MMBTU) per Degree Conferred, and MMBTU per Credit Hour Earned.

Public Policy

NC State is one of 16 campuses in the University of North Carolina (UNC) system. As such, the university is regulated by its Board of Governors and the North Carolina State Legislature. Public policy, specifically focused on energy and water, includes the articles listed below:

- UNC-General Administration (UNC-GA) Sustainability Policy 600.61 – “The University of North Carolina General Administration is committed to leading the State of North Carolina as an environmental steward that endeavors to proactively and effectively manage its impact on energy, water, and other natural resources.”
- North Carolina Session Law 2007-546:
 - Energy consumption in all existing State buildings will be reduced by 20% by the year 2010 and 30% by the year 2015.
 - All new State buildings will be 30% more efficient than ASHRAE standard 90.1-2004.
 - All State agencies will develop a comprehensive plan to manage and report their utilities each fiscal year to the Utilities Savings Initiative.
 - New water systems shall be designed and constructed to use a minimum of 20% less potable water than the indoor water use baseline calculated for the building after meeting the fixture performance requirements by the 2006 North Carolina Plumbing Code.
- In July 2010, the North Carolina State Legislature passed General Statue 143-64.12(a) mandating that 100% of energy savings resulting from energy conservation measures (ECM) at all UNC system schools be returned to the

subsequent fiscal year's utility budget. In addition, 60% of the savings are mandated to be applied to future ECMs, thereby creating funds for a revolving energy savings program.

Highlights and Accomplishments for Fiscal Year 2014

Overview

With yet another year of energy conservation success, NC State has reduced campus energy use by 29%, moving the university closer to its 2015 goal of using 30% less energy than the campus used in fiscal year 2002-2003. For water, the campus has achieved a 46% reduction compared to the baseline of 2001-2002. The state mandate goal to reduce water consumption by 20% has been exceeded and the internal goal of 50% is well within sight.

This Annual Report's 5 focus areas include Data Management, Supply Management, Energy Use in Facilities, Equipment Efficiencies, and Campus Integration.

Data Management

As the University has continued to grow and the metering landscape has evolved, the need for quality assurance of utility data has been identified as paramount. Energy Management completed a review on the process for capturing, storing, reporting, and billing utility data in order to identify opportunities for improvement. This review resulted in process improvement enhancements across the board for data management on campus, from internal processes to software platforms.

Supply Management

NC State purchases electricity, natural gas, fuel oil, domestic water, and sewer from third parties. Utilities and Engineering Services (UE) manages the production of all steam, chilled water, heating hot water, and the new Combined Heat and Power (CHP) system, in addition to all utility distribution on campus.

Two methods of natural gas acquisition are utilized on campus. One method is through Public Service Company of North Carolina (PSNC), referred to as the local utility distribution company (LDC). The second method is through a commodities transport marketer that sells strips (e.g. bulk purchases) of natural gas to large accounts.

The natural gas market is considered to be the most volatile of energy sources used by NC State and for that reason additional diligence is provided for its management. Management of this energy source begins with the selection of a third party market provider that is able to reliably and cost effectively deliver natural gas to the PSNC pipelines. During FY 2013-14 NC State solicited a Request for Quote (RFQ) for a new third party market provider. The RFQ allowed NC State to obtain a new marketer that

offers a price per unit that is 21% less than the marketer on the Term State Contract #405N. This lower marketing fee alone allowed the University to avoid almost \$68,000 in utility costs.

In its second year of operation, the 11 megawatt (MW) CHP facility at the Cates Avenue Steam plant generated cost effective steam and electricity for North and Central Campus. The cost of energy needed to fuel the CHP was monitored closely throughout the year. It was determined that natural gas as a fuel source was the most cost effective fuel source for the system. During periods of natural gas curtailment, due to continuous cold weather conditions, #2 fuel oil had to be utilized. The cost of #2 fuel oil is much higher than natural gas which diminished the cost effectiveness of steam and electricity production on a per unit basis during those periods. However, the operation on #2 fuel oil was considered necessary in order to avoid setting a costly demand peak charge from Duke Energy Progress.

In January 2014, a new contract was awarded to Colonial Energy to provide natural gas strips through 2015. NC State was able to avoid more than \$294,000 in utility costs through this new large volume hedge procurement program.

Innovation in Action: Steam Trap Insulation

Insulating steam traps can provide energy and utility cost savings over time. The purpose of a steam trap is to separate steam and condensate in the distribution system. The condensate is returned to the utility plant boilers and the steam is contained within the distribution lines for use. By insulating the traps the temperature of the condensate returning to the boilers will be higher than it would be if the traps were not insulated. This means that the boilers do not have to consume as much natural gas to reheat the condensate to convert it back to steam. There are more than 200 traps in the five utility plants and steam distribution lines on campus. A project was completed in FY 2014 to insulate all of these traps, resulting in an annual estimated savings of more than \$14,500.

In December 2013, the Yarbrough Steam Plant capacity and reliability of steam and chilled water production was improved when two boilers and one chiller were installed (see Figure 5) as part of the CHP Energy Performance Contract. The new boilers replaced older boilers, which were installed as early as 1949, and complement steam production from the CHP. These upgrades are expected to result in a 14% increase in efficiency.



Figure 5- One of the two new boilers at the Yarbrough Steam Plant

NC State opted out of the Demand Side Management/Energy Efficiency (DSM/EE) program during FY 2014 and avoided electric cost of \$618,249. With this money, NC State performed self-directed ECMs.

Electricity is supplied to campus by Duke Energy Progress. Select NC State electric accounts have been converted to Time of Use (TOU) rates. During FY 2014, \$318,781 in electric cost was avoided by using the TOU account rate instead of the General Service rates.

Domestic water and sewer service is supplied by the City of Raleigh, which increased its water rates by 4.45% during FY 2014.

January 2014 Natural Gas Curtailment Woes

NC State consumes more natural gas than any other UNC System school. In fact, the university is among the largest users of natural gas for PSNC, the local natural gas distributing company. Natural gas is used to create electricity, chilled water, and working steam for campus buildings.

PSNC classifies NC State as an “industrial user” of natural gas. This classification enables the University to take advantage of lower cost “interruptible” natural gas service versus the always-on “firm” service.

Firm service is the highest quality transmission delivery of natural gas under a rate schedule that anticipates no planned interruption. For example, residential users of natural gas are on firm service. Interruptible service, on the other hand, is subject to interruption at the option of the natural gas delivery company. Fees for interruptible service are cheaper than firm service but require the user to have an alternative fuel or the ability to shut down on demand if natural gas delivery is curtailed. NC State relies on low sulfur diesel fuel, or #2 fuel oil, as an alternative to natural gas. The Utilities and Engineering Services team maintains more than 700,000 gallons (approximately 100 tanker truck deliveries) of above ground storage for diesel fuel.

Natural gas delivery interruptions are called “curtailments.” Most commonly, when evening temperatures drop below 30 degrees Fahrenheit, campus heating demand increases and the interstate natural gas delivery pipelines can become strained. When the PSNC natural gas delivery system needs to use less gas to relieve the strain, their representatives notify NC State to curtail natural gas use within one hour or face stiff financial penalties based on mandated rate schedules. At that point, campus combustion turbines and boiler systems are taken off natural gas and converted to fuel oil until the curtailment is lifted by PSNC.

With record-setting cold temperatures in January 2014 on the East Coast, PSNC issued curtailment orders that lasted two weeks. Natural gas usage was shut off and fuel oil was used to operate campus combustion turbines and boilers to generate electricity and heat buildings. The duration of the curtailment required ordering new truckloads of diesel fuel which was nearly impossible because of the sudden, skyrocketing demand throughout the East Coast. Suppliers could not keep up, and there was a very real possibility of running out of diesel fuel, which would have resulted in turning off campus heat.

Fortunately, just enough truckloads were delivered and the weather finally eased. PSNC curtailment was lifted and the campus returned to normal operation. In recent memory, no one could recall a time when the campus came so close to losing its ability to maintain campus buildings.

Energy Use in Facilities

Through the identification and prioritization of ECMs, Energy Management is able to develop plans intended to reduce energy consumption in facilities and help NC State meet, or exceed, standards set by Session Law 2007-546, Energy Conservation in State Buildings.

Projects targeting facilities energy consumption are listed below:

- NC State's Winter Holiday Energy Setback Program avoided \$288,590 in utility costs this year by lowering building temperature set points and turning off equipment and lights during the campus winter holiday break. By comparing the energy consumption to the 2004 baseline year and adding the utility cost component, values of actual dollars saved are calculated. Using this approach, almost \$2.5 million in utility costs have been avoided since the baseline year (see Figure 6).

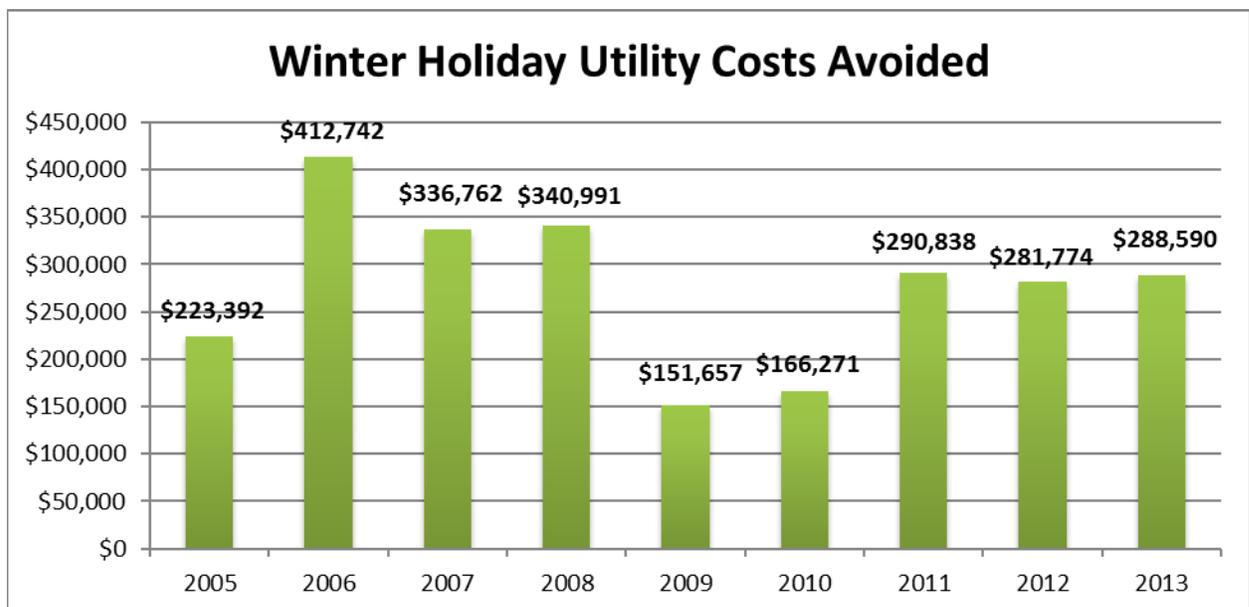


Figure 6- Winter Holiday Setback Program Utility Costs Avoided since FY 2004-05

- Energy Performance Contracting (EPC) is a performance-based procurement method and financial mechanism for building renewal projects whereby utility bill savings that result from ECMs pay for the cost of the building renewal project. Annual reporting on the performance of each EPC occurs through a process known as Measurement & Verification (M&V). NC State currently has multiple EPCs in various stages of completion:

- The 13 Building EPC performance year began on August 1, 2012. In its first performance year, the 13 Building EPC reported \$1,638,479 in guaranteed savings under the EPC M&V Protocol.
 - An EPC was used to finance the 11 MW CHP facility on campus at the Cates Avenue Steam Plant. In its first year of operation, the CHP and Yarbrough Steam Plant Renovation project reported \$5,342,935 in guaranteed savings under the EPC M&V Protocol.
 - The Phytotron building is the third EPC for NC State. This EPC is currently under construction with completion set for September 2014. ECMs include growth chamber and building lighting retrofits; growth chamber updates; heating, ventilation, and air conditioning (HVAC) modifications; control upgrades; and replacement of chillers with connection to the district utility chilled water loop. Energy reductions and avoided utility costs are projected over the 15-year financing period.
 - An engineering study was completed in FY 14 to help determine a scope of work for a fourth EPC on campus. Options may include a multi-building ECM effort along with CHP and Thermal Energy Storage (TES) on Centennial Campus. The estimated discounted payback for the multi-building portion of the EPC is 14.5 years. The CHP at Centennial offers an estimated 13-year discounted payback. If TES is implemented with the CHP, discounted pay back is expected to be 17 years.
- New high performance film was applied to 770 south- and southwestern-facing windows in the DH Hill Library's North Tower and Erdahyl-Cloyd Wing. The ceramic, nearly transparent film reduces the rate of heat transfer through the windows, helping to maintain optimal indoor temperatures year-round while reducing the HVAC load and the building's energy consumption. The window film is expected to reduce the building's annual HVAC consumption by 10%. In addition to reducing heating and cooling costs, the film also blocks ultraviolet rays that are harmful to human skin as well as furniture, books, and other indoor items (see Figure 7).



Figure 7- Window Film Being Applied at the DH Hill Library

- Energy Management provided financial and project management support to energy and water efficient upgrades at Nelson Hall, home of the Poole College of Management. This collaborative project will aid in the qualification for LEED for Existing Buildings certification at Nelson Hall and serve as an educational tool for a new LEED Laboratory class offered on campus. Energy efficient LED lighting in the stairwells, dual technology lighting sensors, and water-reducing dual flush toilets in the restrooms are among some of the upgrades.
- The Building Maintenance and Operations (BMO) Recommissioning Team continued to make great strides to decrease energy usage, increase maintenance efficiency, and improve tenant comfort. Since the program started in FY 2013, the effort has generated more than \$525,000 per year of utility cost avoidance.

Recommissioning is a systematic, documented process that identifies low-cost improvements to an existing building, bringing that building up to the design intentions of its current usage. For building tenants, the benefits of increased comfort are obvious. For the university, it means proper and efficient equipment operation, reduced operations and maintenance costs, building equipment that matches building functions, and improved air quality and occupant productivity.

Equipment Efficiencies

North Carolina Executive Order 156 encourages all state agencies to maximize efforts to develop and implement environmentally sustainable policies and practices that minimize their impact on the environment and reduce overall utility operating cost. NC State is making strides toward implementing projects that reduce overall GHG emissions and operating costs. The following projects are some of the many strategies that the university is deploying to reach its environmental goals and commitments.

- A new boiler control system was installed on the three boilers at the Monteith Research Center. Prior to this improvement, the boilers had to be manually controlled by operations personnel. Additionally, the boilers did not have the ability to communicate with one another and thus were often operating inefficiently. Through the installation of the new boiler control system, the boilers now have a sequence of operations to cycle up or down according to the building heat load and modulate between cycles resulting in a reduction of natural gas consumption. This modification is estimated to reduce natural gas consumption by up to 20%.
- Energy assessments and tune-ups were performed on 21 campus boilers. If a boiler is not properly tuned, it stands the risk of corrosion that results in less heat transfer and therefore demands more energy to produce steam. The estimated annual utility costs avoided as a result of the boiler tune-up project is almost \$52,000.
- Domestic water is used in steam sterilizers, or autoclaves, for quenching (reducing the temperature of) hot effluent water and condensate prior to it entering the sewer drain. Inefficient sterilizers use a constant flow of domestic water, even when the sterilizer is not in use or is turned off, so that cold water is available at any time in case hot effluent is discharged. Technologies are available to retrofit existing sterilizers to reduce water consumption. As a proof of concept project, seven inefficient steam sterilizers were retrofitted with cooling reservoir system technology to reduce water consumption. Before the cooling reservoirs were installed, water flowed continuously at an average of 1 gallon per minute. Through the installation of the cooling reservoir systems, water usage was reduced by an estimated 80-90%.
- During Fall 2013, a Wake On Lan pilot project was completed through collaboration between the Office of Information Technology, the College of Natural Resources, the Office of Sustainability, and Energy Management. The project allowed students, faculty, and staff to remotely power on certain devices (server, desktop computer, etc.) dynamically when needed. The deployment of

this ability campus-wide will depend on feedback from the campus IT support community.

- Replacing traditional lighting systems with LED technology provides financial benefit in the form of lower utility bills and maintenance costs. LED technology has proved to be particularly favorable in campus locations where energy intensive bulbs are being used in hard-to-reach (high ceilings) or heavily utilized spaces. Over the course of the year, LED upgrades were completed in a range of applications including hallways, chandeliers, offices, labs, and high-bays (see Figure 8).



Figure 8- LED High-Bay Lighting Fixtures

- A capital project to replace controls at the DH Hill Library will be completed in phases. Through this project, the original pneumatic based building control system will be replaced with modern direct digital controls (DDC) that will enable point-and-click capability to operate the library in a more efficient manner. Once the controls are upgraded, the building will then be recommissioned to ensure optimal peak energy efficient operation. In FY 2014, the second year of the project, the remaining air handlers that operated on pneumatic controls were upgraded to DDC. The building automation system was also consolidated into a single platform that will streamline the HVAC scheduling process.

Campus Integration

Education and outreach efforts throughout FY 2014 primarily focused on changing the campus culture with regard to energy and sustainability. Realizing maximum energy savings on campus does not happen without the involvement of students, faculty, and staff. Collaboration between Energy Management, the University Sustainability Office, and other campus partners led to energy conservation awareness through activities and initiatives including:

- NC State received an Award for Excellence from the Utility Savings Initiative of the North Carolina Department of Environment and Natural Resources, recognizing the university's progress and leadership in campus energy efficiency (see Figure 9).



Figure 9- NC State USI Award Presentation

- NC State issued a university-wide sustainability policy in February 2014, solidifying its commitment to advancing sustainability through the life of the university. Accompanying the policy are sustainability standard operating procedures that provide specific guidance for implementing the policy on campus, including energy and water efficiency guidelines.
- Lab users were encouraged to shut open fume hood sashes, which are among the university's biggest sources of energy loss. As part of Energy Action Month in October 2013, lab users in Dabney Hall competed to see which side of the building could reduce energy use by shutting the fume hood sash when not

actively working at the fume hood. Throughout the Spring 2014 semester, a student intern with Energy Management and Environmental Health and Safety walked through campus labs shutting open fume hoods and educating users on the importance of doing so.

- Change Your State, originally developed as an energy conservation campaign in 2010, was re-launched in August 2013 as a yearlong sustainability awareness campaign for NC State students, faculty, and staff. With more than a dozen campus partners, the campaign provided education on eight sustainability topics, including energy and water conservation, through numerous outreach events and initiatives, including a blog-based website viewed by nearly 9,000 readers in its first year. A related social media advertising campaign to promote energy and water conservation on campus resulted in conservation messaging being viewed more than 2.5 million times by 11,000 individuals.
- In April 2014, residents in Metcalf, Bowen and Carroll Residence Halls reduced their energy use an average of 25% and water use by an average 20% during the student-led Tri-Towers Energy and Water Challenge.
- Two NC State seniors inspired students to care more about water-related problems by organizing a week of conservation-focused programs, including speakers, games to promote water awareness, and a field trip to NC State's Water Research Lab.
- In Spring 2014, 15 students in a Food Science class analyzed energy and water usage at NC State's Howling Cow Creamery, which processes up to 400,000 gallons of milk each year into ice cream and other dairy products. The students' research helped improve the efficiency and sustainability of the case washer, which the creamery uses to cleanse milk storage cases.

Centennial Campus Smart Grid Master Plan

A smart grid is a utility infrastructure that utilizes two way communications to monitor and control a utility grid using real-time data to improve reliability and overall system efficiency by incorporating multiple energy consumption and generation sources. The two major smart grid subdivisions are macro and micro. A smart macro grid is typically a utility provider, while a smart micro grid is generally an individual campus, such as a university. The smart micro grid is a key component to the successful operation of a macro smart grid.

The NC State Centennial Campus is a nationally recognized research campus for Smart Grid initiatives. Due to continued growth, University leadership recognized the need to increase the size of the current electrical distribution system on campus. The purpose of this smart grid master plan is to identify and prioritize projects which will improve the reliability of the electrical distribution system, improve energy conservation, and support the University's goal of being a national leader in smart grid technology.

This study was developed through a synergistic combination of a design consultant's experience with smart grid technology and master planning along with the in-depth knowledge provided by a variety of University departments including utilities and engineering, facilities, campus planning, sustainability, and academic research to develop a plan tailored to the goals and needs of the Centennial Campus. From the data gathered, it was determined that the master plan needed to address three primary smart grid categories: smart grid research, distributed generation, and a smart campus control system. These three categories address the University's unique needs while targeting a significant reduction in energy consumption and improved reliability:

Smart Grid Research – The University currently conducts a large amount of research related to the smart grid and its components. It was determined that one of the smart grid's most desirable benefits would be providing access to real-world testing and data. The development of a *Smart Grid Proving Grounds*, a group of existing and new facilities where researchers and industry can further test and study smart grid technologies, will maximize research benefits.

The focal point of the *Proving Grounds* would be the AC/DC test circuit, which would provide a safe means of testing AC and DC power including the integration of a variety of renewable sources such as solar photovoltaics (PV).

Smart Campus Control System – The University currently has a variety of building automation systems that control the mechanical systems in a facility. At present, these systems operate independently of each other and the central utility plant. A new smart campus control system at Centennial Campus would integrate these systems together and provide constant system-wide, two-way communication. The campus would operate as one fluid system instead of more than 20 independent systems. The smart campus control system would utilize advanced analytics to optimize energy consumption on campus while also collecting data for researchers.

Distributed Generation – A key component of a smart grid is providing distributed generation sources. The consultant evaluated a variety of distributed generation sources and system improvements that would increase overall system reliability. The areas addressed included cogeneration, thermal storage, standby generation, and other distributed generation sources. The evaluated distributed generation projects covered a wide range of payback periods.

Various technologies related to the three smart grid categories were reviewed, and specific projects for implementation on Centennial Campus were evaluated. The results and recommendations of the smart grid projects can be found in the Implementation section of the plan.

Charting NC State's Utility Consumption

Tracking Campus Utility Consumption and Distribution

Energy Management tracks utilities delivered to most campus buildings, including several leased spaces. Purchased utilities from third party vendors and utilities provided by the Central Utility Plants are tracked and reported.

Energy consumption peaked in FY 2008-09 and has declined steadily since (see Figure 10). The sharp decline over the last two years can in large part be attributed to the installation of campus CHP. The CHP, along with ECMs in buildings and the efforts from the campus community, have placed the university within striking distance of the 2015 energy reduction goal of 30%. As of this fiscal year, energy consumption compared to baseline is 29% less.

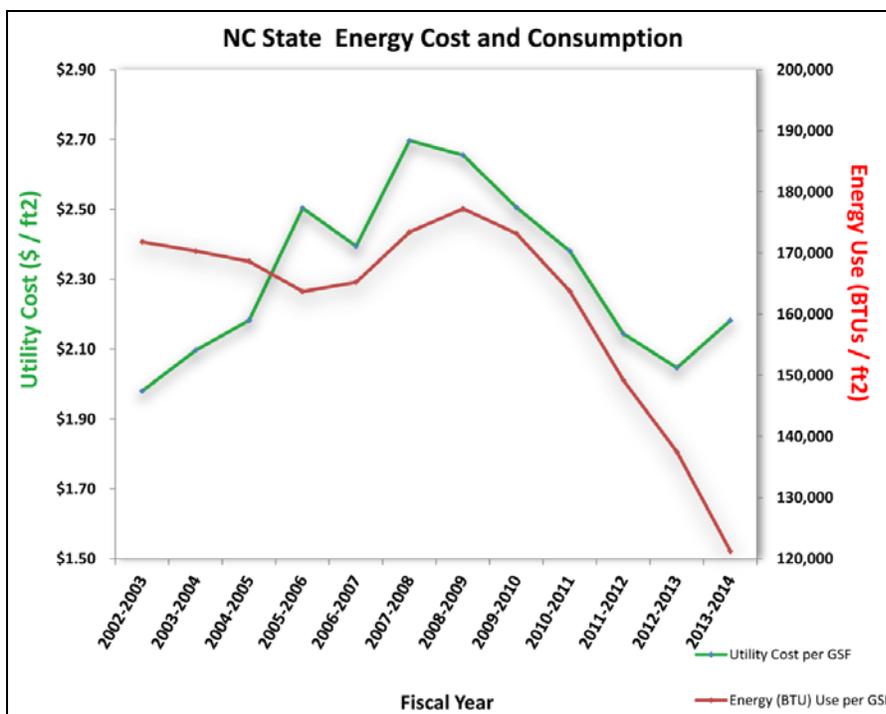


Figure 10- Energy Consumption and Utility Cost per GSF

A 7% increase in the utility cost per GSF, as compared to last year, was observed this year. This increase is linked to the natural gas curtailment period that occurred over the winter. During the curtailment period, fuel oil was purchased as an alternative to natural gas. The price of fuel oil is much greater than natural gas and the impact is apparent in the utility costs per GSF increase.

Utility meter data is captured monthly in the eDNA Billing System (EBS) software. For the most critical metering, data is captured in real-time. Eventually, all metering devices will be captured in real-time, per the Campus Automation Master Plan. The historical information from all data capturing sources is tracked in the Oracle database monthly data and in the proprietary Extended Distributed Network Architecture (eDNA) database for real-time monitoring. While Energy Management uses these meters extensively for tracking consumption of receipt-funded entities, it also provides benchmarking for utility consumption of the various building types.

NC State’s annual reporting is based primarily from the supply-side, or purchased utilities. Data from sub-metering on the demand-side is presented when available.

Energy and Water Consumption

Facility Energy and Water Consumption

The university continues to initiate impactful strategies to minimize energy and water consumption. Campus CHP has vastly decreased overall energy use per GSF. In FY 2014, the total energy consumption for NC State was 29% less when compared to the baseline year of 2002-2003. Campus water use has decreased by 46% per GSF when compared to levels observed in the baseline year of 2001-2002. This year the total utility cost for NC State was \$32,664,515 (see Table 1).

| Utility | Consumption | Consumption | Cost |
|---------------------|---------------------|------------------------------------|---------------------|
| Electricity | 208,327,176 kWh | 710,812 MMBTU | \$16,112,209 |
| Natural Gas | 15,824,510 Therms | 1,582,451 MMBTU | \$8,591,879 |
| Fuel Oil #6 | 44,316 Gallons | 6,647 MMBTU | \$147,909 |
| Fuel Oil #2 | 1,334,698 Gallons | 184,188 MMBTU | \$4,113,112 |
| Total Energy | | 2,484,099 MMBTU | \$28,965,110 |
| Water | 400,022,920 Gallons | 534,790 CCF | \$3,699,405 |
| Stormwater | | | \$136,158 |
| | | Total Energy and Water Cost | \$32,664,515 |

Table 1- Energy and Water Summary

Energy Management's continued efforts have contributed to the downward trend in energy and water consumption. By expanding ECMs, metering, monitoring, and reporting efforts, the team has provided campus leadership with the tools to achieve greater conservation. As a result, the trends indicate that energy usage is at the lowest levels since reporting began.

Key Performance Indicators

Annual Report Utility Data

Each year NC State, along with other public universities and community colleges across the state, provides an annual report showing the status of energy usage and progress toward short- and long-term goals. Along with traditional KPIs (e.g., Cost per GSF, BTU per GSF, Consumption per GSF), NC State continues to report several additional KPIs annually, including Energy Consumption per 1,000 GSF per Degree Day, Utility Cost per Student, MMBTU per Academic Degree Conferred, and MMBTU per Credit Hour Earned (see Table 2).

| Unit of Measurement | 2002 Water Baseline | 2003 Energy Baseline | 2010 | 2011 | 2012 | 2013 | 2014 | % Change (1 yr.) | % Change (Baseline) |
|--------------------------------------|---------------------|----------------------|------------|------------|------------|------------|------------|------------------|---------------------|
| Utility Cost/GSF | \$1.73 | \$1.98 | \$2.51 | \$2.38 | \$2.14 | \$2.05 | \$2.18 | 7% | 10% |
| Energy Cost, \$/1,000 GSF/DD | \$0.341 | \$0.357 | \$0.43 | \$0.40 | \$0.42 | \$0.36 | \$0.38 | 5% | 5% |
| Energy Consumption, BTU/GSF | 155,974 | 171,866 | 173,213 | 163,766 | 149,226 | 137,523 | 121,358 | -12% | -29% |
| Energy Consumption, BTU/GSF/DD | | 32.75 | 32.7 | 29.54 | 32.98 | 27.05 | 23.61 | -13% | -28% |
| Water Cost, \$/GSF | \$0.119 | \$0.106 | \$0.17 | \$0.19 | \$0.23 | \$0.22 | \$0.25 | 13% | 108% |
| Water Consumption, CCF/GSF | 0.066 | 0.054 | 0.0373 | 0.0346 | 0.0378 | 0.0338 | 0.036 | 6% | -46% |
| Gallons per Acad. Degree Conferred | 1,739,190 | 1,467,907 | 1,140,796 | 1,221,272 | 1,571,202 | 1,538,046 | 1,886,524 | 23% | 29% |
| Heating and Cooling DD, Yearly | 4,710 | 5,248 | 5,385 | 5,543 | 4,525 | 5,084 | 5,141 | 1% | -2% |
| Campus Area, GSF | 9,796,638 | 9,910,619 | 12,915,905 | 13,738,383 | 14,164,153 | 14,453,596 | 14,966,918 | 4% | 51% |
| Sponsored Award Activity, Million \$ | \$167.6 | \$173.1 | \$266.2 | \$270.0 | \$286.1 | \$228.8 | \$304.5 | 33% | 76% |
| Utility Cost per Student, \$/FTE | \$584 | \$701 | \$1,059 | \$1,061 | \$984 | \$951 | \$1,066 | 12% | 52% |
| MMBTU per Acad. Degree Conferred | 278.08 | 273.23 | 315.50 | 291.17 | 255.00 | 237.68 | 212.04 | -11% | -22% |
| MMMBTU per Credit Hour Earned | 2.32 | 2.54 | 2.81 | 2.77 | 2.61 | 2.63 | 2.26 | -14% | -12% |

Table 2- Key Performance Indicators

Baselines: Highlighted Cells

The methodology for reporting the benefits garnered through the operation of the CHP was adjusted this year. For the first year of operation, the benefit of CHP emphasized the reduction of purchased electricity that was used to calculate campus energy performance. That was, and still is, an acceptable method to measure the benefit of CHP. The NC Department of Environment and Natural Resources, the regulatory recipient of this strategic energy and water report, asked NC State to consider the benefit of the steam generated by waste heat, which is also an acceptable method to measure the benefit of CHP. The result of this evaluation is a revision in the BTUs/GSF KPI as shown in Table 2. Going forward, the annual energy and water report will measure the benefit of CHP using the benefit of steam generated by waste heat.

To be clear, this revised calculation is not the same as M&V requirements as defined by the CHP EPC. The measurement and verification calculations include certain model stipulations, while the KPI calculations are based exclusively on utility meter readings without model stipulations.

Figure 11 visualizes the growth of campus along with total utility consumption. By smarter building and operations, energy consumption per GSF is trending downward and is at the lowest level since reporting began more than a decade ago (see Figure 11).

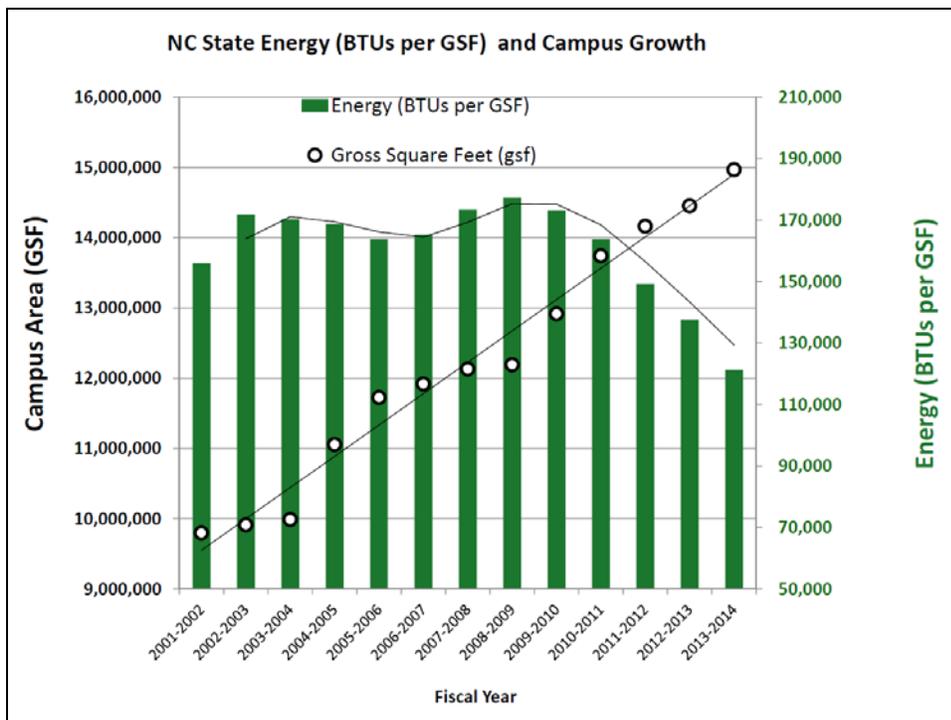


Figure 11- Total Utility Cost and Campus Growth

Trends in Energy and Water Consumption

Energy Consumption Metric

In FY 2014, NC State realized the benefits of a multi-faceted effort to reduce energy consumption across campus. Through a combined effort from Facilities Operations, led by Energy Management, the total energy consumption per GSF decreased by 29% and continued the downward trend toward the goal of 30% total energy reduction by FY 2015 (see Figure 12).

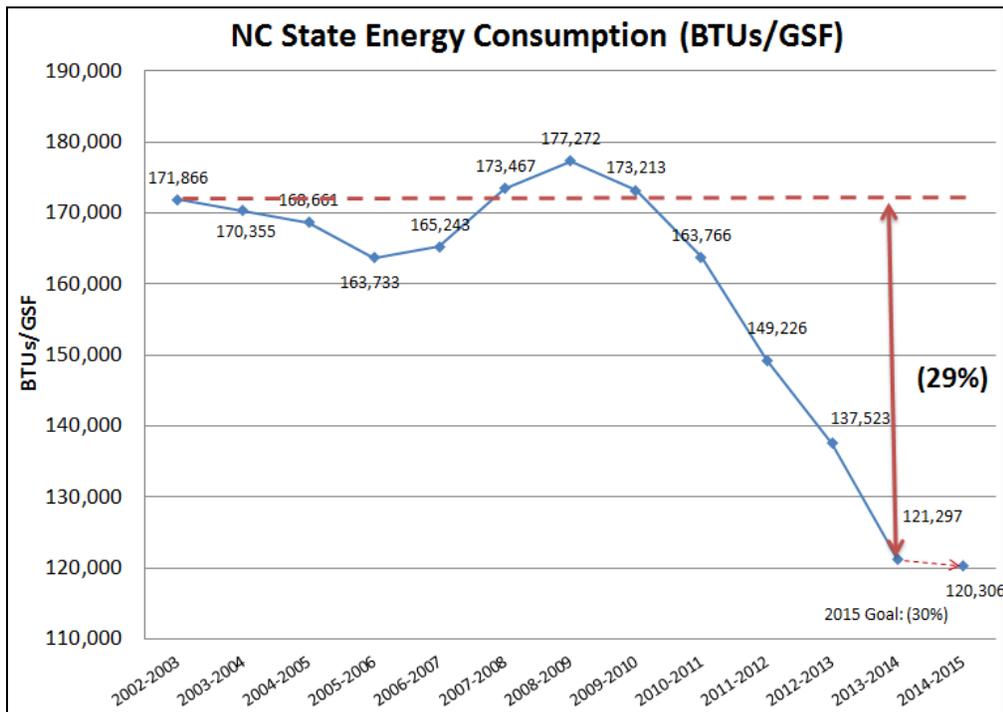


Figure 12- Energy Consumption per GSF

Water Consumption Metric

Water conservation programs continue to show a decrease in use compared to baseline (see Figure 13). A total reduction of 46% has been achieved toward the goal of 50% by FY 2015.

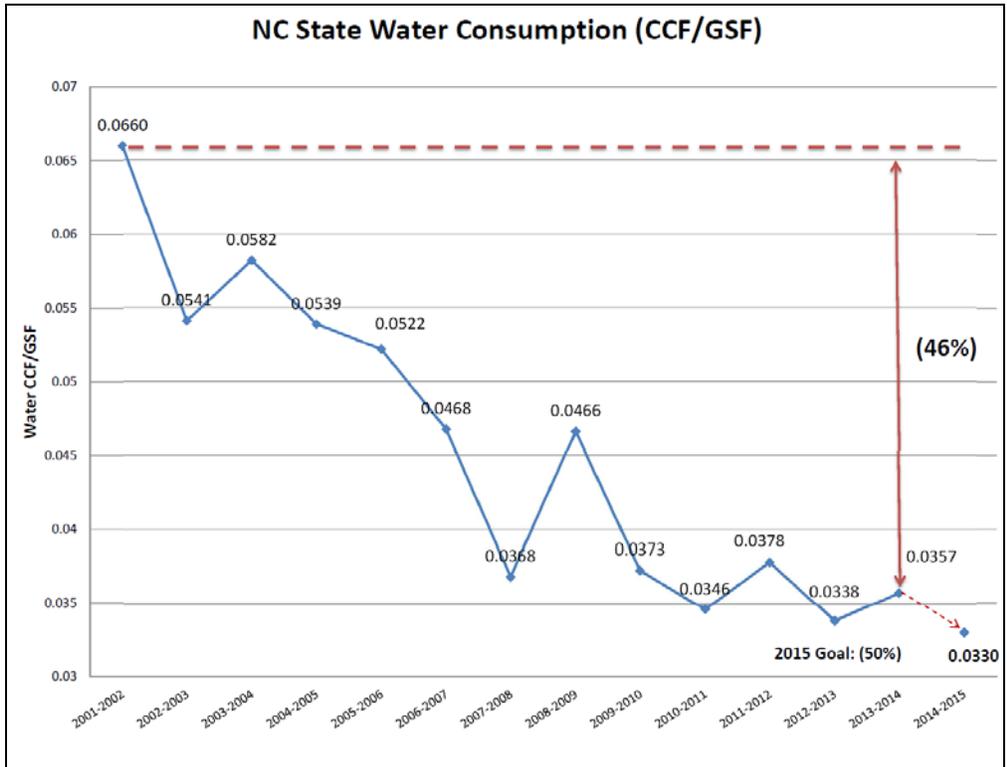


Figure 13- Water Consumption per GSF

Campus Comparison

The number of academic degrees conferred correlates to campus population and activity. Energy consumption per academic degree has consistently dropped since FY 2008 (see Figure 14). Since the NC State student population is a major indicator of energy use on campus, these metrics are relevant and show a decrease in energy use per student and per academic degree conferred.

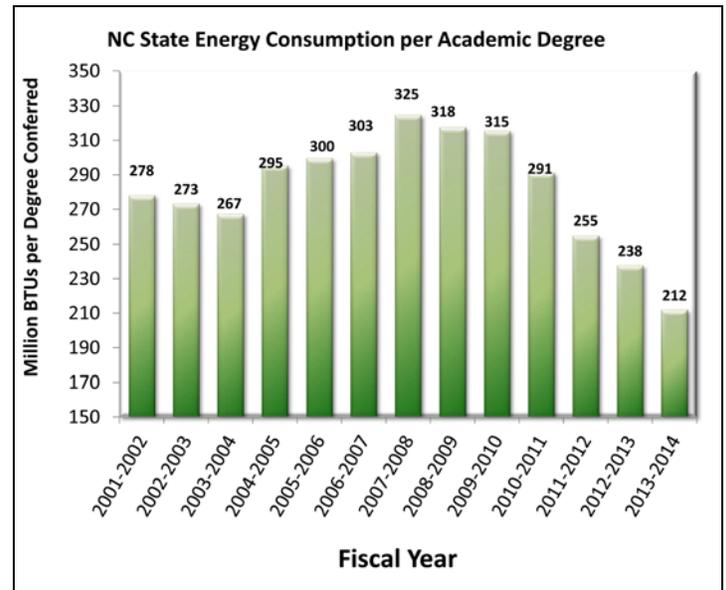


Figure 14- Energy Consumption per Academic Degree Conferred

Academic Degrees Conferred is based on information available at the time of this report from the Office of Institutional Research and Planning

Weather Normalized

Another factor Energy Management has applied to normalize energy consumption is weather conditions. This method accounts for changes in campus square footage per degree day (see Figure 15). This metric shows campus consumption per degree day at the lowest level since the baseline year.

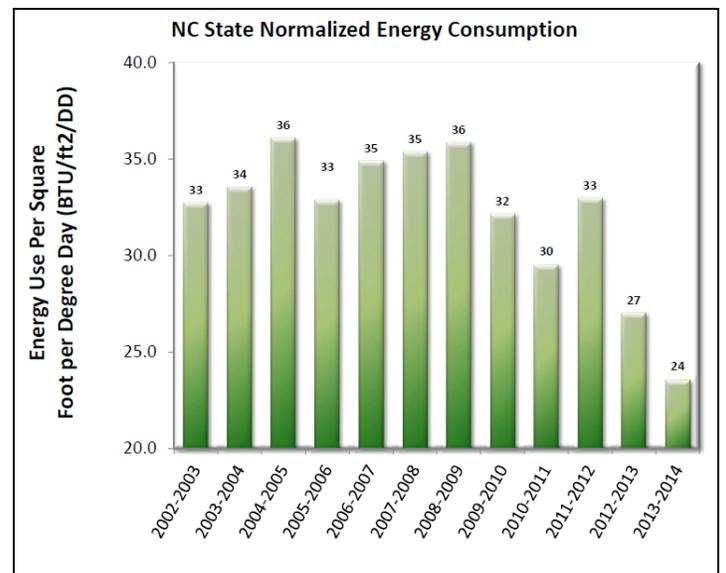


Figure 15- Normalized Energy Consumption

Trends in Energy and Water Costs

Energy and Water Cost Metrics

When compared to the two previous years, energy cost per GSF increased this year (see Figure 16). The primary driving force behind this change is the natural gas curtailment that was experienced in January 2014. At that time, a record setting cold month forced PSNC to issue curtailment orders that lasted two weeks. Natural gas usage was shut off and fuel oil was used to operate campus combustion turbines and boilers to generate electricity and heat buildings. The cost of fuel oil is much greater than natural gas and the impact of this higher expense may be observed in the increase in utility cost per GSF.

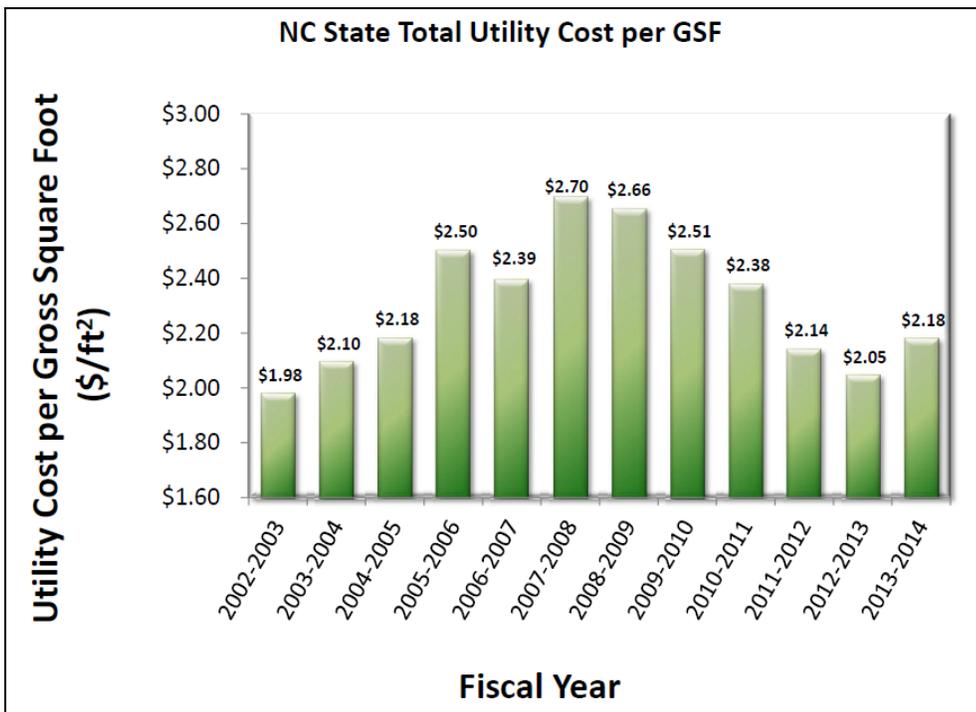


Figure 16- Utility Cost per GSF

Looking Ahead to Fiscal Year 2015

Projections for 2015

The *Sustainability Strategic Plan*, encompassing the *Climate Action Plan* and *Strategic Energy Management Plan*, are the road maps that will ensure continued progress toward the 2015 goals for energy and water consumption and the stretch goal for carbon neutrality by 2050. Progress over the past five fiscal years has formed the foundation for future energy reduction in FY 2015 and into the foreseeable future.

Data Management

The goal of Data Management is to provide meaningful information for efficient operation and use of university resources. This discipline provides the tools that allow for greater GHG abatement, larger energy and water reductions, better scheduling for resource use, smarter purchasing tactics, and greater involvement from the campus community. The following focus strategies concentrate Data Management efforts:

- Use KPIs to expand upon the long-range plan to model energy consumption and then frame actionable items accordingly.
- Set goals to prioritize energy reduction and carbon abatement strategies to further the university's mission.
- Facilitate EPC related M&V analysis and reporting.
- Conduct new construction and major remodel M&V analysis and reporting for Session Law 2007-546.
- Procure and integrate a proprietary expert monitoring and control system that will enable a campus-wide view and exception reporting.
- Procure and install a proprietary energy dashboard system that will allow the campus community to view and track energy reduction and carbon abatement on digital and web-based displays.
- Continue expansion of wireless meter reading technologies that will enable more real-time data capture and reporting.
- Modernize the Sullivan, Centennial, and Centennial Biomedical Substations and install new Supervisory Control and Data Acquisition (SCADA).
- Publish periodic campus energy and water consumption reports.

Supply Management

Supply management will continue to be improved in terms of the purchasing, production, and distribution of utilities. The following is a look ahead to NC State's energy supply management initiatives and programs that will be addressed during FY 2015.

- Continue to monitor and operate the CHP and District Utility Plant equipment in the most cost-effective manner possible. The pre-purchase of natural gas, as strips, into calendar year 2016 is the most cost effective procurement method. In order to pre-purchase natural gas strips, NC State will be soliciting costs for this service using a new RFQ.
- Track the purchase cost of fuel oil and make recommendations on when to utilize it in the CHP operations.
- Explore benefits and work with University Purchasing to purchase natural gas at the most lowest rate possible.
- Review accounts with major monthly change in natural gas usage compared to prior month and prior year to determine if action is needed.
- Further optimize natural gas usage by recommending the best frequency to wash the CHP compressors.

Energy Use in Facilities

Energy Management will continue making strides to ensure that buildings are operated and maintained in a manner that ensures optimal performance.

- Phase III of the BAS modernization at the D.H. Hill Library will be complete.
- The Building Maintenance and Operations Recommissioning Team will tune-up building heating, ventilating, and air conditioning in at least four campus buildings.
- The 13 Building and CHP EPCs will continue to provide guaranteed savings under Performance Year 2.
- The Phytotron Building EPC construction will be completed and the first Guaranteed Performance Year will begin.
- Certain older campus buildings have outdated and inefficient interior lighting systems, which will be replaced with modern, energy-efficient lighting. For common areas, like computer labs, hallways, and restrooms, lighting controls will be installed to control when lights are on.

Equipment Efficiency

The following programs and policies concerning equipment efficiency will be implemented:

- Implement a rolling schedule for evaluation and tune-up to achieve optimal peak efficiency in boilers of all sizes.
- Continue to test and repair failed steam traps.
- Install insulation jackets on building steam traps to reduce heat loss.
- Retrofit inefficient autoclaves with water-saving technology.
- Provide incentives to the campus community to replace old and energy-inefficient equipment.

Campus Integration

Saving energy and reducing the university's carbon footprint will require the buy-in of the Campus Environmental Sustainability Team (CEST). During FY 2015, in partnership with the University Sustainability Office, Energy Management will promote campus integration through the following outreach programs:

- Implement the comprehensive university-wide Sustainability Policy and associated Standard Operating Procedures.
- The university-wide sustainability campaign called Change Your State will continue efforts to inspire students to address some of society's great challenges, including energy and water efficiency, through simple actions that save money and natural resources while improving human health and the environment.
- NC State Stewards are student leaders who will encourage campus energy and water conservation through peer-to-peer training and outreach.

Declarations

STRATEGIC ENERGY AND WATER PLAN COMMITMENT FOR NC STATE UNIVERSITY

Energy and water are controllable expenses wherein savings result in reducing overall operating cost. Energy and water management is a responsibility of the staff, faculty, and students at each facility, guided and supported by the Energy Manager.

- North Carolina State University will develop a Strategic Energy and Water Plan.
- The Director for Utilities and Engineering Services is responsible for the success of the program at the campus facilities.
- The Energy Program Manager is responsible for implementation of North Carolina State University's Strategic Energy and Water Plan.
- The Assistant Vice Chancellor for Facilities Operations will review progress and results quarterly.

STRATEGIC ENERGY AND WATER PLAN COMMITMENT - GOALS

The University will implement strategies to meet the following goals:

- Achieve a 30% reduction in building energy consumption by 2015 against the 2003 baseline.
- Achieve a 50% reduction in building water consumption by 2015 against the 2002 baseline.
- Improve energy data management capabilities and make data-driven decisions utilizing enhanced energy data.
- Train and educate staff and building end-users to properly operate and maintain building systems in an energy-efficient manner.
- Ensure a cost-effective and reliable energy supply by developing business scenarios and strategies for diversifying fuel sources.
- Evaluate utility financial structures that create incentives for saving energy.
- Implement green standards and practices for information technology and computing.

STRATEGIC ENERGY AND WATER PLAN - COMMITMENT

Implemented October 2014

Signature on File

Energy Program Manager

Signature on File

Director of Utilities and
Engineering Services

Signature on File

Assistant Vice-Chancellor for
Facilities Operations

Signature on File

Associate Vice-Chancellor for
Facilities Division

Appendix Tables

| Energy Data Management Activities during FY 2014 | Annual Avoided Utility Cost | Cost | Assigned to |
|---|-----------------------------|------------------|-------------|
| Finalized upgrade to EBS Oracle server and eDNA real-time Data Historian | N/A | FTEs | EM |
| Implement new Modbus service for additional point monitoring for M&V | N/E | FTEs | EM |
| Install wireless meter reading technologies | N/A | FTEs | EM |
| Developed new streamlined processes for billing | N/A | FTEs | EM |
| Begin development in partnership with vendor on billing software enhancements | N/A | \$16,500 FTEs | EM |
| Begin development in partnership with handheld software vendor for meter data collection enhancements | N/A | \$4,250 FTEs | EM |
| Procure a proprietary expert building monitoring and control system | TBD | \$19,659 FTEs | BM&O EM |
| Procure a proprietary energy dashboard system | TBD | \$73,140 FTEs | EM |

| Projected Energy Data Management Activities for FY 15 | Expected Annual Avoided Utility Cost | Cost | Assigned to |
|--|--------------------------------------|------------------|-------------|
| Complete development in partnership with vendor on billing software enhancements | N/A | \$16,500 FTEs | EM |
| Complete development in partnership with handheld software vendor for meter data collection enhancements | N/A | \$750 FTEs | FTEs |
| Continue refinement of long range meter plan | N/A | FTEs | EM |
| Procure a proprietary energy dashboard system | TBD | FTEs | EM |

| Energy Supply Management Activities during FY 2014 | Annual Avoided Utility Cost | Cost | Assigned to |
|---|-----------------------------|----------|-----------------|
| Reconcile savings on natural gas accounts | \$362,000 | FTEs | EM |
| Duke-Progress DSM/EE opt-out | \$618,249 | FTEs | EM |
| Reconcile savings on electrical accounts service versus TOU | \$318,781 | FTEs | EM |
| Update natural gas, electricity, and water rates in the EBS billing system | N/A | FTEs | EM |
| District Utility Plants and Distribution System Steam Trap Repair and Replacement Program | \$11,632 | \$10,000 | UE EM |
| District Utility Plants and Distribution System Steam Trap Insulation Program | \$14,500 | \$33,000 | UE EM |
| Load Shedding Program | \$25,548 | FTEs | UE EM BMO |

| Projected Energy Supply Management Activities | Annual Avoided Utility Cost | Cost | Assigned to |
|--|-----------------------------|----------|-----------------|
| Evaluate and reconcile the purchase of strip and transport type gas volumes monthly | TBD | FTEs | EM |
| Monitor the efficiency of the CHP equipment | TBD | FTEs | EM |
| Reconcile savings on electrical accounts service versus TOU | TBD | FTEs | EM |
| Perform load shedding | TBD | FTEs | UE EM BMO |
| Survey and Repair Steam Traps in the District Utility Plants and Distribution System | TBD | \$10,000 | UE EM |
| District Utility Plants and Distribution System Steam Trap Insulation Program | TBD | \$10,000 | UE EM |

| Energy and Water Use Activities during FY 2014 | Annual Utility Cost Avoided | Cost | Assigned to |
|---|-----------------------------|-------------|------------------|
| Winter Holiday Energy Setback Initiative | \$288,590 | FTEs | EM BMO FO |
| Building Recommissioning Programs | \$525,000 | \$390,000 | BMO EM |
| Miscellaneous Lighting Upgrades | \$1,500 | \$7,414 | EM BMO |
| Project scoping, planning and construction for Self-Performance Contract at Phytotron | N/A | \$4,500,000 | EM CPM BMO |
| 13 Building EPC | \$1,638,479 | \$1,412,714 | UE EM BMO |
| CHP EPC | \$5,342,935 | \$4,275,774 | UE EM |
| Window Film Installation at DH Hill Library | TBD | \$69,033 | EM |
| Fume Hood Closure and Modernization Program | \$7,000 | \$1,480 | EM EHS |
| Nelson Hall Lighting and Bathroom Fixture Upgrades | TBD | \$27,092 | EM |
| Building Envelope Repairs at Peele Hall and SAS Hall | \$8,533 | \$38,845 | EM |
| Building Control Software Upgrades | TBD | \$90,000 | BMO |

| Projected Energy and Water Use Activities | Expected Annual Utility Cost Avoided | Cost | Assigned to |
|---|--------------------------------------|-------------|------------------|
| Building Recommissioning Program | \$600,000 | \$330,000 | BMO EM |
| Self-Performance Contract at Phytotron | \$600,000 | \$4,500,000 | EM CPM BMO |
| Continue 13 Building EPC | \$1,591,000 | \$1,443,916 | UE EM BMO |
| CHP EPC | \$4,588,550 | \$3,680,761 | UE EM |
| Winter Holiday Energy Setback Initiative | \$300,000 | FTEs | EM BMO FO |
| LED Lighting Upgrades | TBD | \$30,000 | EM |
| Lighting Control Program | TBD | \$15,000 | EM |

| Equipment Efficiency Activities during FY 2014 | Annual Utility Cost Avoided | Cost | Assigned to |
|--|-----------------------------|-----------|-------------|
| DH Hill Building Control Upgrades | N/E | \$400,000 | BMO EM |
| LED Upgrade at Constructed Facilities Lab | TBD | \$52,642 | EM |
| Boiler Control Installation at MRC | \$31,723 | \$20,000 | BMO EM |
| Boiler Tune-Ups | \$51,764 | \$12,131 | EM |
| Sterilizer Water Efficiency Program | \$25,000 | \$16,821 | EM |
| Humiliation System Modifications at BRF | TBD | \$25,000 | BMO |
| Chiller Upgrades at Butler Communications | TBD | \$9,457 | BMO |
| Install Steam PRV at Partners III | TBD | \$5,752 | BMO |
| Install AHU Controller at Engineering Building III | TBD | \$5,200 | BMO |
| Wake on Lan Pilot Project | TBD | FTEs | OIT EM |

| Projected Equipment Efficiency Activities | Expected Annual Utility Cost Avoided | Cost | Assigned to |
|---|--------------------------------------|-----------|-------------|
| DH Hill Building Control Upgrades | TBD | \$400,000 | BMO EM |
| Sterilizer Water Efficiency Program | TBD | \$25,000 | EM |
| Building Steam Trap Insulation Program | TBD | \$35,000 | EM BMO |
| Boiler Tune-Ups | TBD | TBD | EM |

| Campus Integration Activities during FY 2014 | Annual Utility Cost Avoided | Cost | Assigned to |
|---|-----------------------------|---------|-------------|
| Create and pass a sustainability policy and energy regulation | N/E | FTEs | CEST |
| Launch the Sustainable Workplace Certification program | N/E | FTEs | USO EM |
| Fume Hood Competition at Dabney Hall | N/E | FTEs | EM USO |
| Residence Hall Energy Competition | TBD | FTEs | UH |
| Education and Outreach | N/E | \$5,000 | USO EM |

| Projected Campus Integration Activities | Expected Annual Utility Cost Avoided | Cost | Assigned to |
|---|--------------------------------------|----------|-------------|
| Education and Outreach | TBD | \$10,000 | USO EM |
| Residence Hall Energy Competition | TBD | FTEs | UH |
| Implement the sustainability policy and energy regulation | TBD | FTEs | CEST |



STRATEGIC ENERGY AND WATER ANNUAL REPORT IS PRODUCED BY
NC STATE ENERGY MANAGEMENT

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