



NORTH CAROLINA  
A&T  
STATE UNIVERSITY  
GREENSBORO, NORTH CAROLINA 27411

2008-2009  
STRATEGIC ENERGY PLAN  
SUMMARY \* DATA \* PLANS \* GOALS \* BUDGET \* MANDATE

OCTOBER 2008

# STRATEGIC ENERGY PLAN

## TABLE OF CONTENTS

	Page
I. Executive Summary	3
• Introduction	
• Baseline Energy Usage	
• Key Actions	
• Savings Estimate & Financial Evaluation	
II. Baseline Energy Use	7
III. Planned, Completed Action and Projects	7
• Saving Assessment	
• Goal and Measures	
IV. Consumption and Dollars	10
V. Energy Plan in Action	11
VI. Glossary of Terms	19
VII. Declaration Page	21

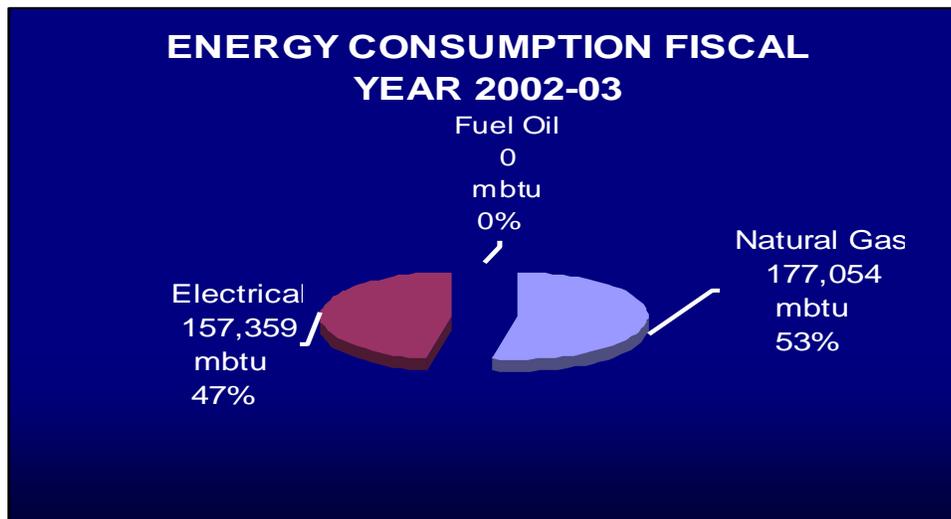
# I. Executive Summary

## Introduction

North Carolina A&T State University (NC A&T) has initiated many actions relative to energy conservation with great success. Additionally, groundwork has been laid to: (1) implement a facility-wide preventive maintenance system; (2) install a Comprehensive Integrated Metering and Monitoring System (CIMMS) for utility usage as well as an Energy Management and Control System (EMCS); and (3) initiate performance contracting. The utility management and accounting software is operational and historical data has been collected for all utility accounts. Verification and account auditing is ongoing to take full advantage of the system's functions to detect errors, incorporate weatherization and to forecast budget.

## Baseline Energy Usage

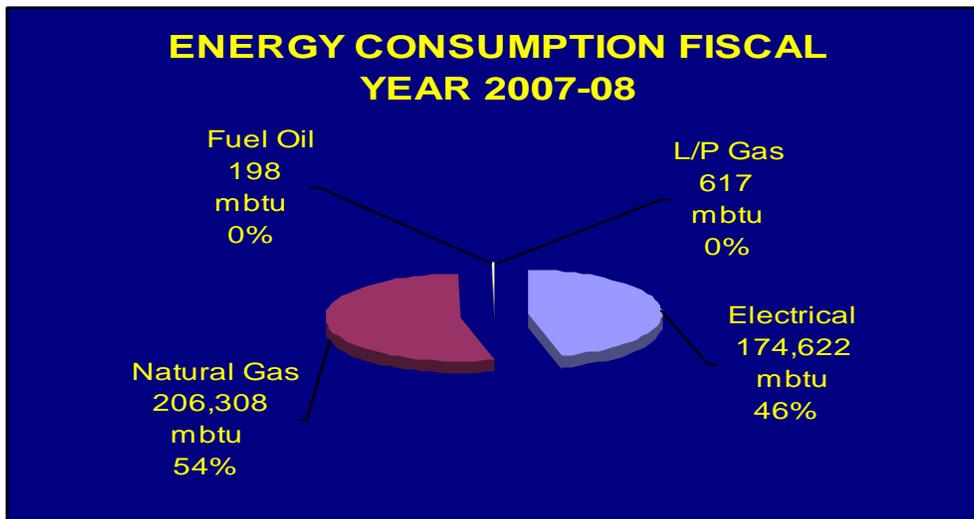
- North Carolina A&T State University's total baseline energy consumption for FY 02-03 was 334,413 mbtu. This included: natural gas 177,054 (53%) mbtu and electrical at 157,359 (47%) mbtu. No fuel oil was used during the baseline year. The overall energy efficiency for FY 2002-03 was 141,847 mbtu/gsf. This ratio establishes the baseline upon which our future energy efficiency is measured. The State goal was to reduce total facility energy consumption by 20% per gross square foot by the end of FY 2007-08. Attainment of this goal has been extended to FY 2010. Additionally, a goal of 30% reduction in facility energy use per gross square feet must be achieved by 2015.



- **Current Energy Use in Facilities:** During FY 07-08 NCA&T achieved a 12% reduction in energy use per gross square feet. Although, all buildings have some form of control of key energy systems such as heating and cooling, many systems are unreliable and need to be upgraded. The HVAC systems are of mixed manufacturers

and present some problems for the anticipated installation of a Centralized Energy Management and Control System. All of the newer buildings are equipped with time clocks or computerized software capable of supporting programming for lighting on/off schedules. Additionally, light sensors have been installed in many classrooms and offices throughout the campus.

Many of the older buildings are equipped with outside temperature sensors that automatically turn the building's steam and hot water heating systems on and off. Temperature reset devices are also used to lower/raise temperatures as outside temperatures change saving energy by preventing the overheating of interior spaces. Recommended temperature ranges were established by previous university policy and are posted on the university energy web page. Additionally, credit card size thermometers are issued to campus personnel to measure room temperature, to inform the customer, and to prevent unnecessary calls when temperatures are within range of policy guidelines. Usage of energy and utilities is measured on a campus wide basis but additional sub-metering is required. Some energy reduction opportunities have been implemented and others have been identified and are awaiting funding.



- **Energy Data Management:** NC A&T has transitioned from the past system of utility data management. The on-going implementation of the new system allows all energy bills to be collected and reviewed in a centralized location. Once bills are reviewed for accuracy, utility expenditures are distributed to primary campus customers thus enabling them to be a part of energy conservation and awareness. A cost allocation plan has also been implemented where utility cost is allocated to various departments based on a percentage of the total campus gross square footage. The sub-metering program continues to be a key focus area. Specifications for sub-meters have been developed for our largest customer, the residence halls.
- **Energy Supply Management:** Electric energy is supplied to the campus main sub-station by Duke Power and distributed throughout the campus where it is sub-metered at some locations. The campus electrical system has undergone numerous upgrades,

which continue to have a positive impact on electrical energy consumption. Natural gas for the central steam plant is purchased on the open market or coordinated under the state contract with Texican. Prices are evaluated on a month-to-month basis to determine the cost of burning natural gas vs. No. 2 fuel oil.

- **Equipment Efficiency:** A basic preventive maintenance system is in place for all facilities; however, significant progress has been made towards the development and implementation of an improved system with automated scheduled maintenance cycles. McNair Hall has served as a pilot location for all trades to have scheduled preventive maintenance, which includes a monitoring system and an equipment identification tagging system. A reliability centered maintenance program has already been implemented in the central steam plant and steam related systems and has resulted in substantial savings and overall efficiency of that entity. A chiller survey has been completed and Energy Conservation Measures (ECMs) have been identified. Funding has been identified for the installation of a chilled water system that will supply cooling to five (5) buildings on the southeast campus. This project started with the renovation of Morrison Hall. Vanstory Hall was added and construction on Barbee hall began in 2007. The addition of Morrow and Benbow Halls to the chilled water loop system in the next phase will complete this project.
- **Organization Integration:** The Physical Plant Director provides overall leadership and direction of the Energy Awareness and Conservation Team. The day-to-day responsibility for energy management is under the stewardship of the University Energy Coordinator. He received support from other staff members who provide assistance with energy related tasks, newsletters, data collection, and energy conservation and awareness. The University Energy Coordinator reviews monthly bills for errors and investigates the source of unusual consumptions. Additionally, he and the support staff will aggressively pursue, implement and enforce the campus energy policy once it is implemented.

### **Key Actions**

A baseline assessment previously accomplished revealed certain actions which could improve energy consumption and have the potential of reducing campus overall utility usage by 20-30%. This assessment is based on all identified processes, programs and projects identified for funding. The desired results will be less if funding is not available. These actions are outlined as goals below:

#### **Process Improvements:**

- Billing error resolution.
- Rank order facilities by key performance indicators (KPIs) and use most efficient facilities during summer school.
- Strategically house students and staff during summer school to allow for isolation of parts of steam system.
- Improve the operation of key systems.

**Program Implementation:**

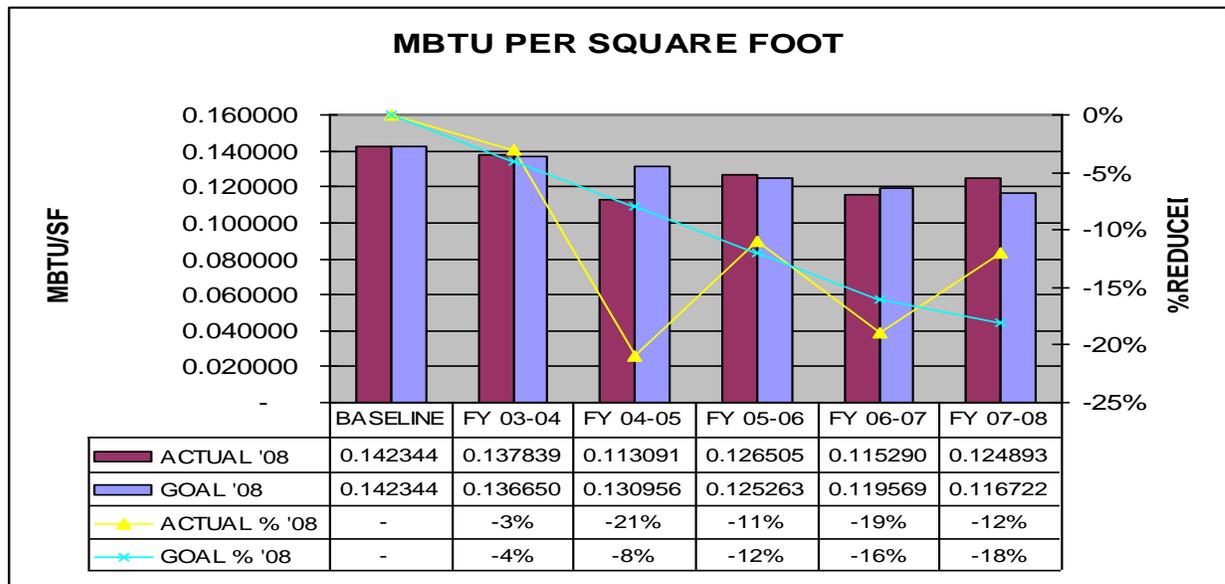
- Campus-wide Energy Policy
- Energy awareness program
- Reliability Centered Maintenance program
- Energy audit of all buildings

**Projects:**

- Implement performance contracting
- Repair underground steam and condensate leaks and install steam vs. electric powered condensate pumps.
- Seal steam manholes and tunnels to prevent heating of groundwater.
- Install CIMMS and EMCS.
- Install occupancy sensors in classrooms, hallways and offices campus wide.
- Implement a program to install plug load timers for window air conditioning units in all building with window units.
- Replace faulty fan coil units and install programmable thermostats throughout campus.
- Repair identified energy conservation measures (ECMs) from chiller survey.

**Goals and Measures**

The focus of this plan is to achieve conservation without compromising the comfort and safety of students, faculty and staff. With rising energy cost and decreasing budgets, it is imperative that a Strategic Plan be implemented to assist in accomplishing these goals with an emphasis on energy awareness and efficient equipment operation.



Our goal for energy reduction for FY 2007–08 was set for -18% from the baseline year. Our efforts fell short of our goal because both electrical and natural gas consumption increased during the fiscal year. Electrical consumption increased by 5% from the previous fiscal year and natural gas climbed to 19% above the last fiscal year. With needed repairs in progress on the steam and condensate lines, hopefully we can reverse this trend to get back on track to meet the state’s requirements.

## **II. Baseline Energy Use**

NC A&T is developing an Energy/Utility Management Program that will be comprehensive in its approach to ensure efficiency, reliability and accuracy. Two buildings (New School of Education – 57,105 sf and the Fitness Center – 25,900 sf) were added to the campus’ electrical, natural gas and water systems and will increase our use of natural gas for heating and domestic hot water. The renovation of Barbee Hall (71,537 sf) will also increase our use of electrical and water; and Barbee Hall was added to the chill water loop for cooling.

One of the goals of the Facilities Department is to install a CIMMS to enable usage and cost to be analyzed for errors. This information could also be used in identifying and monitoring excessive variations. At present, most systems are not monitored locally. This makes it almost impossible to establish a reliable baseline.

## **III. Planned & Completed Actions and Projects**

The Strategic Energy Plan (SEP) Performance Scorecard describes the processes, programs and projects needed to improve the campus energy management program. The basic rating reveals that the program has much work to be accomplished. There is also great potential for immediate savings. Energy information gathering is a priority and must be implemented if the University is to move forward with a beneficial strategic plan.

### **Process Improvement**

- |  |                       |
|--|-----------------------|
| 1. Improve the operation of key systems by implementing low cost/no cost EMCs  | Initiate: In progress |
| 2. Collect data from existing meters for gas and electricity. Review data monthly for errors and unusual variations. Compare bills with previous bills and other facilities. | Initiate: In progress |

### **Program Implementation**

- |   |                  |
|---|------------------|
| 1. Expand the implementation of the Campus - wide Energy Policy | Status: On going |
|---|------------------|

2. Energy audit of all buildings (conducted annually)
3. Reliability Centered Maintenance Program Phase 2

Status: On going

Status: On going

### Energy Supply Management

Past Accomplishments (FY 2002-07)	Measurement	Savings Actual/Estimate	Cost	Funding Source
Check bills for errors	194 monthly bills		16 hrs/month	Salary
Fuel rates				
Meter verification	Yearly			Salary
Sub-metering	In-progress			R&R

### Equipment Efficiency (Completed)

Past Accomplishments (FY 2002-07)	Measurement	Savings Actual/Estimate	Cost	Funding Source
Occupancy sensors	7 buildings	\$ 82,455.00	\$ 25,925	Operations
Thermostatic radiators valves	4 buildings	\$146,106.00	\$ 15,000	Operations
HVAC Tune-ups	5 buildings	\$934,290.00	\$ 26,000	SEO / Operations
HVAC repairs	2 buildings			Operations
Mechanical room up-grades	7 buildings		\$132,872	Operations
Steam trap survey confined spaces				Operations
Boiler tune-up	Boilers #1 & #2			SEO / Operations
Repair to steam manholes	6 manholes		\$355,974	R&R
HVAC tune-ups	5 buildings			SEO / Operations
Irrigation meters	4 meters		\$ 985	

### Equipment Efficiency (Completed)

Accomplishment FY 2007-08	Measurement	Savings Actual/Estimate	Cost	Funding Source
Occupancy sensors	7 buildings	\$6,195 /month	\$44,659	Residence Life/ Operations
Electrical meter	McNair Hall		\$ 3,074	Operations
Water meter	McNair Hall		\$ 4,800	Operations
Energy misers	13 buildings	\$4,327	\$ 3,121	Operations
Water conservation	30 buildings	\$6,838	\$ 4,409	Operations

### Equipment Efficiency (Planned)

Projects in Planning	Measurement	Savings Actual/estimate	Cost	Funding Source
HVAC Tune-Ups	4 buildings		\$ 8,000.00	SEC Operation
Meters (water / condensate)	McNair Hall		\$8,00.00	Operation
Meters	15 buildings		\$397,500.00	Operation
Meters	7 buildings		\$236,300.00	Auxiliary/ Athletics
Meters	8 buildings		\$550,000.00	Residence Life/ Operations
Occupancy sensors	15 buildings		\$60,000.00	Operation
Performance contracting	5 building			3 <sup>rd</sup> Party ESCO
Monitoring cooling towers	17 buildings		\$10,000.00	Operation

## IV. Consumption and Dollars

### SUMMARY OF FY 2007-08

#### TOTAL ENERGY, WATER COST AND CONSUMPTION

Total energy and water cost per square foot	\$ 1.73
Total energy cost per square foot	\$ 1.52
Total energy consumption per square foot (btu/sf)	124,805
Water consumption including sewer and storm water in gallons	48

#### TOTAL ELECTRICAL COST AND CONSUMPTION:

Total electrical cost	\$2,562,950
Electrical cost per square foot	\$ .84
Electrical consumption per square foot (btu/sf)	57,119
Electrical consumption in kwh	51,178,672

#### TOTAL NATURAL GAS COST AND CONSUMPTION:

Natural gas in therms	2,063,083
Natural gas cost	\$2,066,987
Natural gas cost per square foot	\$ .60
Natural gas consumption per btu per square foot	67,484

#### TOTAL FUEL OIL COST AND CONSUMPTION:

Fuel oil consumption in gallons	1,658
Fuel oil cost	\$ 8,750
Fuel oil cost per square foot	\$ .003
Fuel oil consumption per btu per square foot	.0001

#### TOTAL L/P GAS COST AND CONSUMPTION:

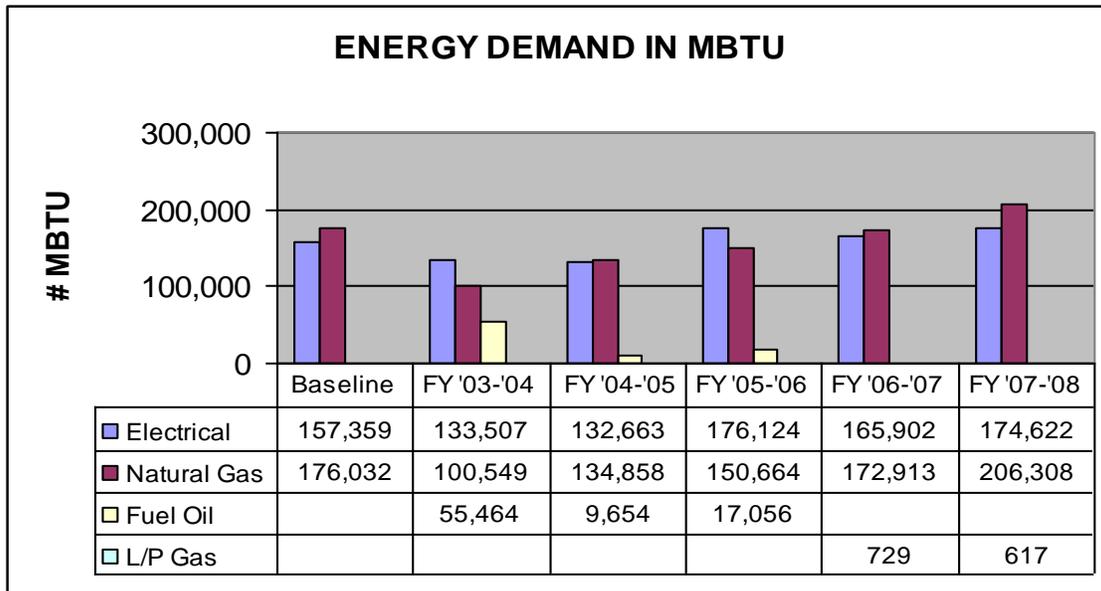
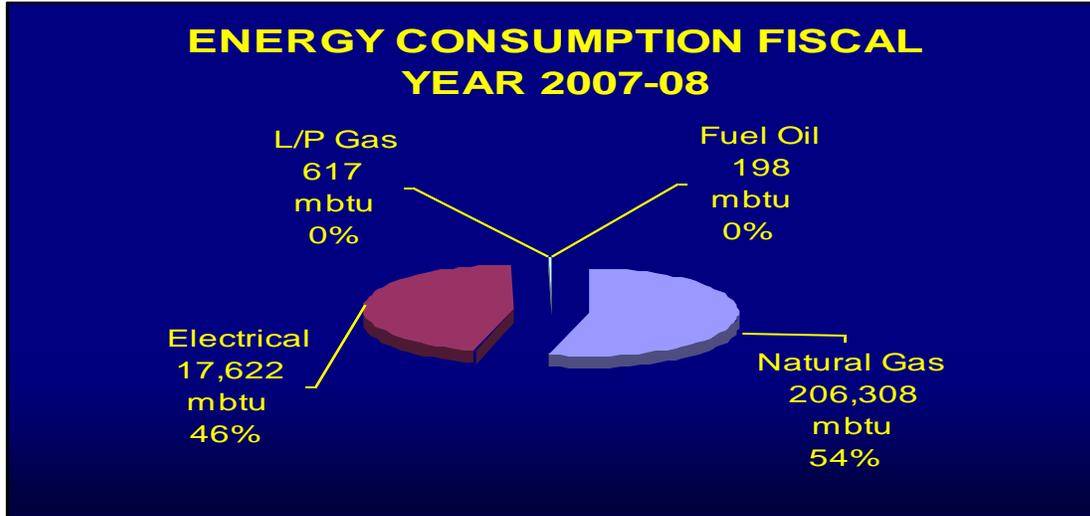
Total L/P gas cost	\$13,175.00
L/P gas consumption in gallons	6,702
L/P gas cost per square foot	\$ .0004
L/P gas consumption per square foot	.0002

#### TOTAL WATER COST AND CONSUMPTION:

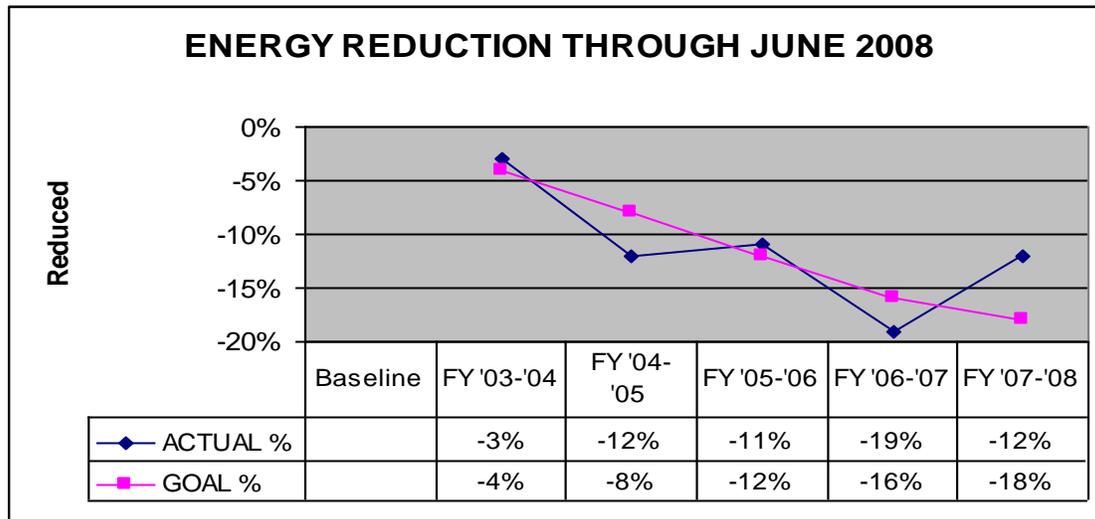
Water, sewer and storm water consumption in gallons	148,160,100
Total water cost including sewer and storm water	\$ 642,375
Water consumption in gallons per square foot	24
Water cost per square foot	\$ .12
Water cost including sewer and storm water per square foot	\$ .21

V. Energy Plan In Action

ENERGY USE IN MBTUs



**% OF REDUCTION FOR FY 2007-08**



**ELECTRICAL CONSUMPTION:**

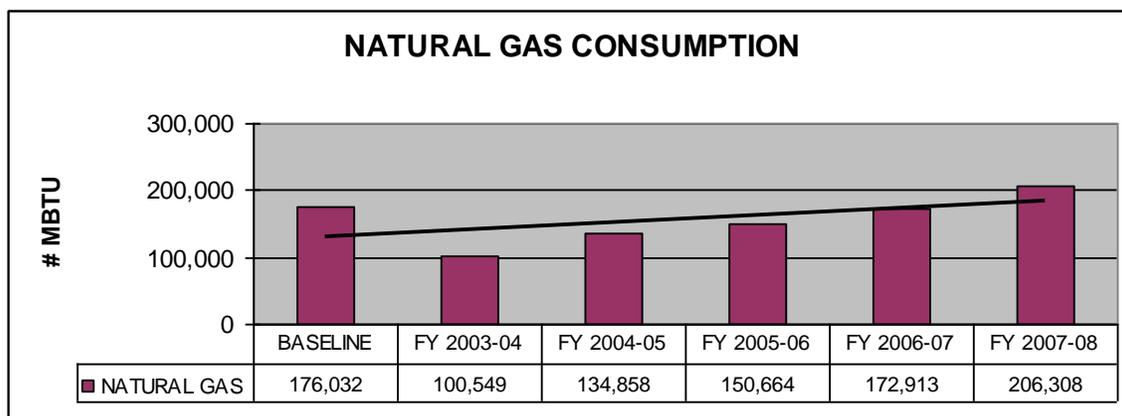
Electrical consumption increased by 5% in FY 2007-08 over the previous fiscal year. The addition of new buildings (New School of Education -57,150 sq. ft and the Fitness Center - 25,900 sq.ft.) and the newly renovated Barbee Hall - 71,537 sq ft for a total of 154,587gsf is now air conditioned space. More motors, pumps and lights will surely increase electrical consumption.

A total of 234 occupancy sensors were installed in seven (7) residence halls to combat electrical consumption. The savings from this installation is estimated to be at 108,900 kwh per month. The sensors were installed in locations where lights normally stay on 24 hours per day.

Energy misers were added to drink and snack machines throughout campus. These machines use 1,223,943 kwh per year; the energy misers will reduce this consumption by 33% - an estimated voidance of 403,901 kwh per year.

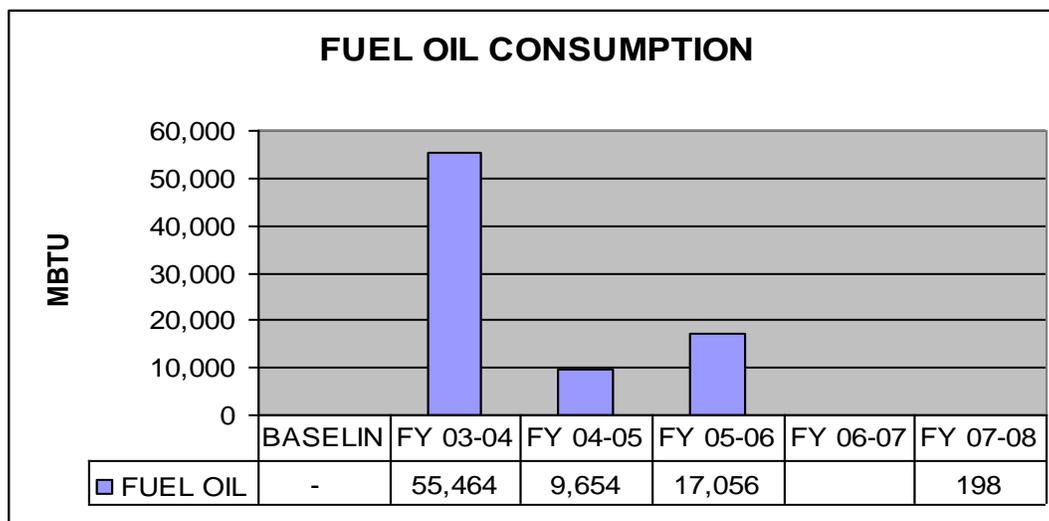
**NATURAL GAS CONSUMPTION:**

Natural gas consumption increased 19% from fiscal year 2006-07. We believe this substantial change was due to the addition of two new buildings (School of Education and The Fitness Center) and re-occupancy of Gibbs and Hines Halls after renovation. The new buildings use natural gas for both heating and domestic hot water and the renovated buildings use steam from the steam plant which uses natural gas as its primary fuel. The four facilities add over 181,000 SF of heating requirements. In addition, the renovated facilities were under construction during 2006-07 creating low use per square foot. Other contributing factors included failed steam and condensate lines (man hole #3, Bluford Library etc... that are now being repaired.



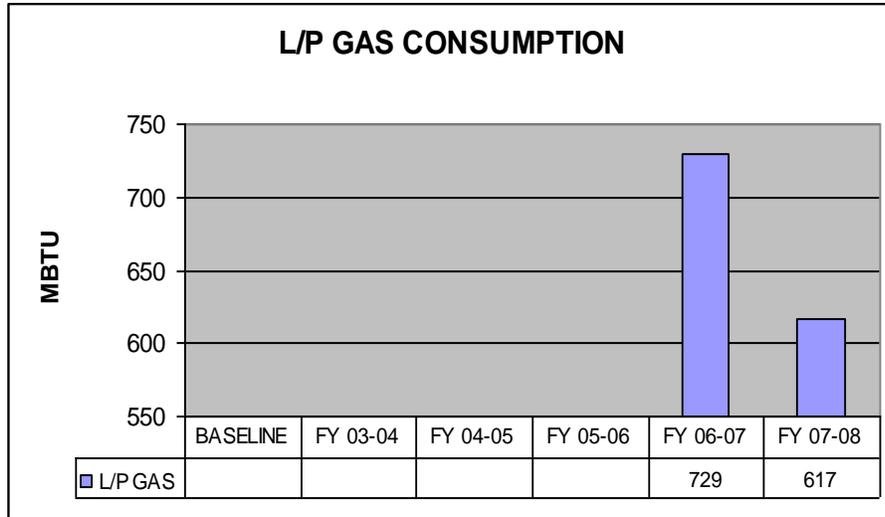
### #2 FUEL OIL CONSUMPTION:

The steam plant uses #2 fuel oil as a secondary fuel; it was not used this fiscal year. Natural gas was plentiful and the price was a little cheaper than fuel oil.

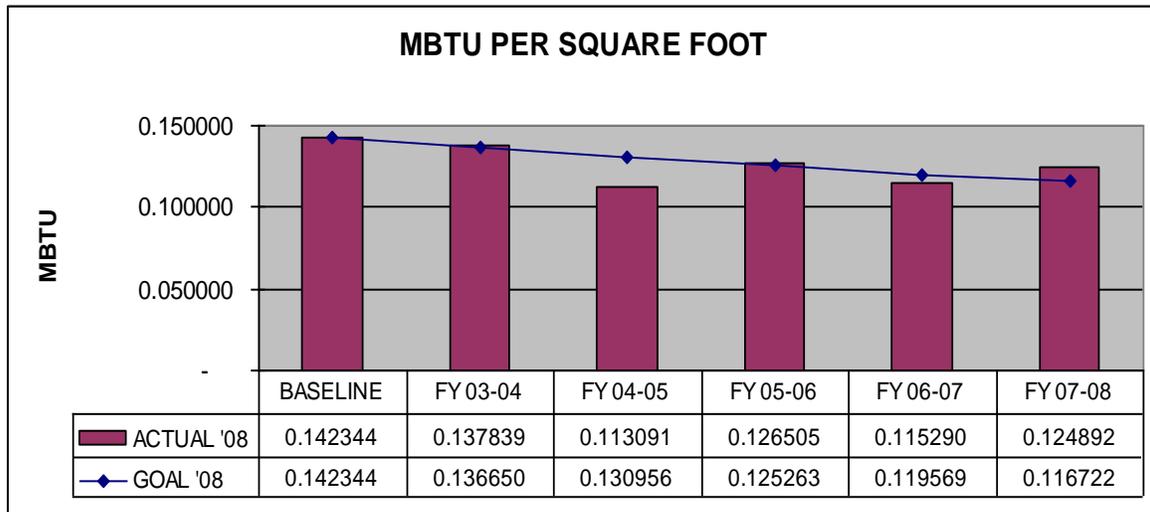


### L/P GAS CONSUMPTION:

L/P gas is used primarily for heating and domestic hot water at the University's Farm Complex and at the steam plant for starting boilers. There is no great demand for L/P gas by any other area of the campus. As compared with the other utilities, this is the second year L/P gas consumption was tracked.



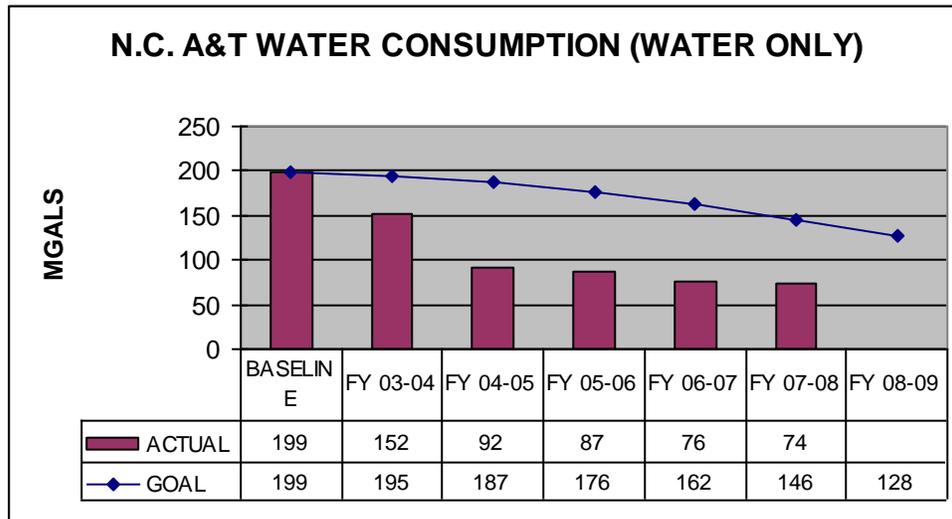
### ENERGY PER SQUARE FOOT



MBTUs were 6% off our stated goal for the year, due to the addition of two new buildings (School of Education and the Fitness Center) and the renovation of one Barbee Hall which has more lights and air conditioners.

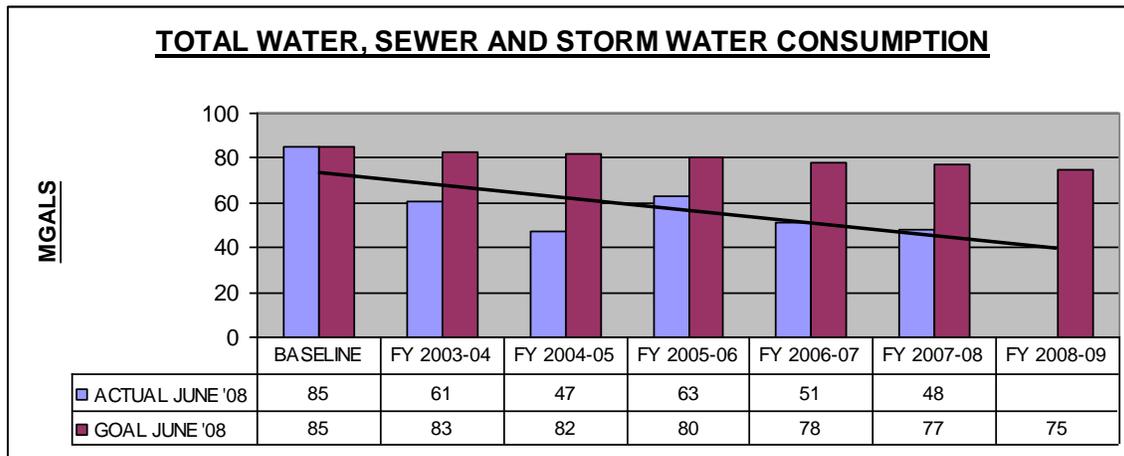
Repairs on steam and condensate leaks on the main lines at manhole #3 have begun.

## WATER CONSUMPTION (WATER ONLY)

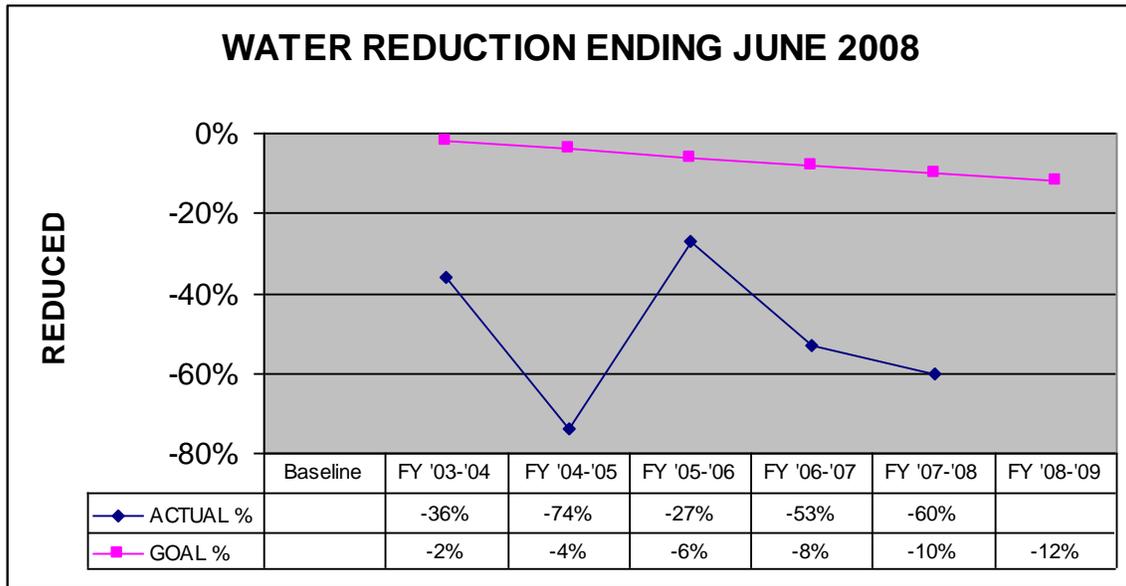


Water consumption decreased 13% from FY 2006-07. Students were informed of our water conservation efforts and the plumbing shop stepped up their preventive maintenance program. Student involvement played a big role in getting the word out to conserve. They made announcements and put on skits to drive the point home. We intend to employ their help again this year and hope to expand their role and efforts.

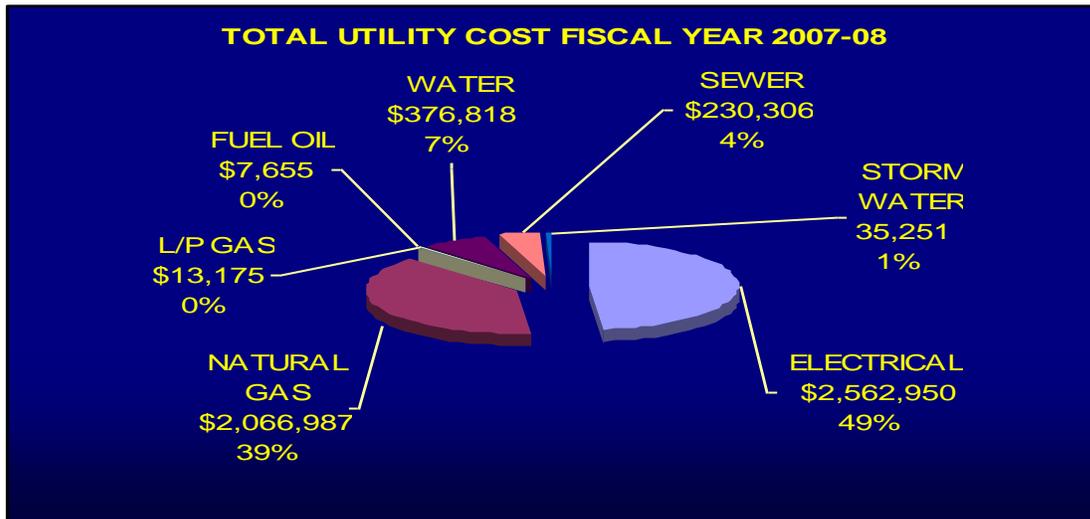
The Plumbing Department installed low flow devices throughout the campus, with a heavy concentration on residence life buildings. A total of 900 aerators that used 3-5 gallons per minute were replaced with ones that uses 1.6 gallons per minute. One hundred shower heads (using 3-5 gallons/water per minute) were replaced with one that used 1.5 gallons per minute. Low flow fill valves on toilets and urinals were also installed. New low flow toilets were in several locations.



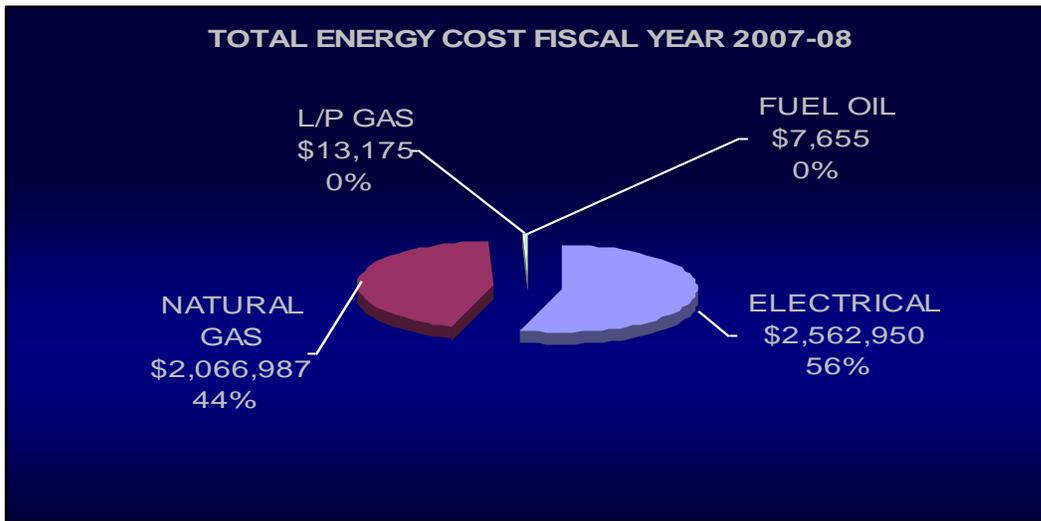
**WATER REDUCTION CHART:**



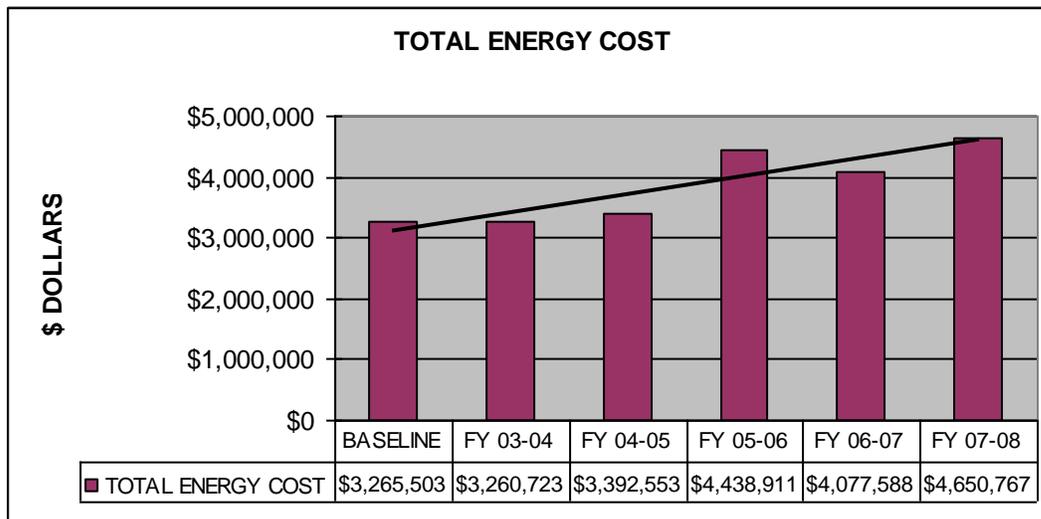
**TOTAL UTILITY COST FOR FY 2007-08:**



**TOTAL ENERGY COST FOR FY 2007-08:**

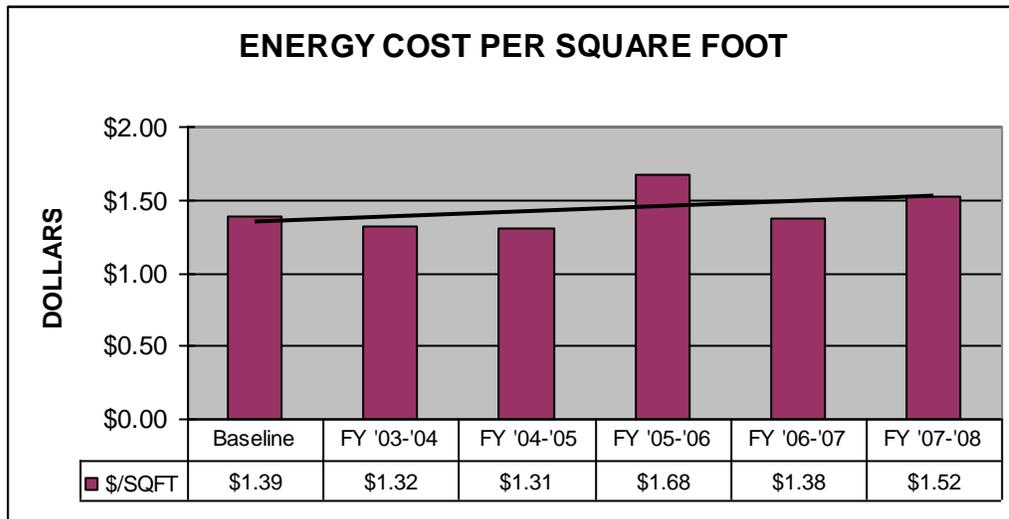


**TOTAL ENERGY COST FROM BASE YEAR THRU FY 2007-08:**



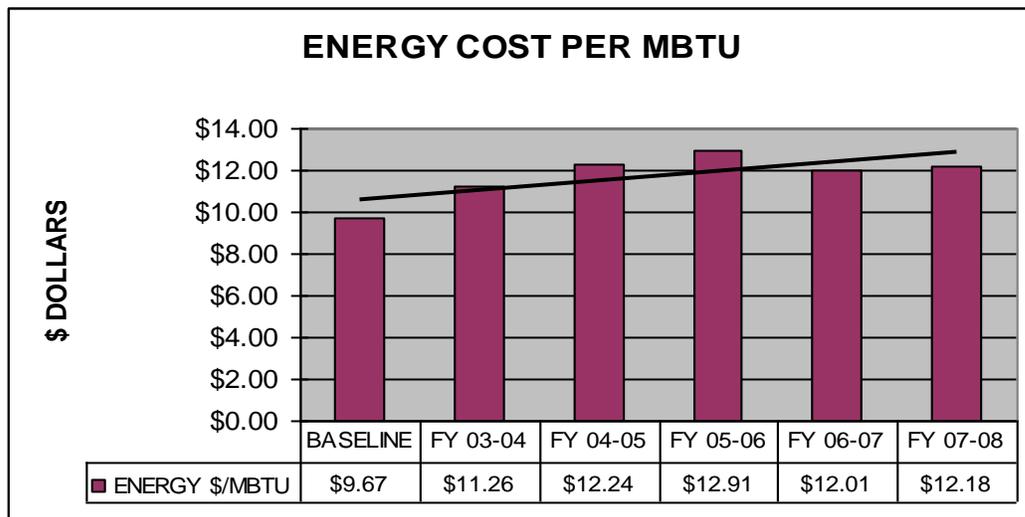
Total energy cost increased by 12.18% from FY 2006-07 to FY 2007-08. Natural gas was the biggest contributor, it increased by \$492,704 over the fiscal year.

**ENERGY COST PER SQUARE FOOT:**



Total energy cost per square foot increased by 10.15% over the past FY.

**TOTAL ENERGY PER MBTU:**



Total energy cost per mbtu increased by 1.3% over the past FY.

## **VIII. Glossary of Terms**

**CIMMS** – Comprehensive integrated metering and monitoring system – computer based metering and monitoring system for utilities management in which energy cost, usage and variations are analysis based on benchmark or expected usage.

**DOE** – Department of Energy

**EMCS** – Energy Management and Control System

**ECM** – Energy Conservation Measures

**FY** – Fiscal Year

**HVAC** – Heating Ventilation and Air Conditioning

**KPI** – Key Performance Indicators- indicators, which relate energy use and cost to building performance. (i.e. – KWH or therms per square foot)

**RCM** – Reliability Centered Maintenance – a proactive approach to maintenance based on maintaining reliability, efficiency and problem avoidance within the system.

**KWH** – kilowatt per hour

**MBTU** – Thousands British thermal unit



Declaration Page

*We recognize energy as a controllable operating expense wherein savings result in dollar for dollar increase in funds available for reinvestment back into the continuing renewal of the campus infrastructure mission of the University. Energy conservation is the responsibility of the entire Aggie Family, guided and supported by the Facilities staff.*

I have read the Strategic Energy and Water Plan for North Carolina Agricultural and Technical State University.

The plan, as present, supports the reduction required in Senate Bill 668.

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*Utility Coordinator  
Mr. James R. Johnson*

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*Physical Plant Director  
Mr. Carey Baldwin*

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*Vice Chancellor of Facilities  
Mr. Andrew M. Perkins, Jr.*

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*Vice Chancellor of Business & Finance  
Mr. Robert Pompey, Jr.*

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*Chancellor  
Dr. Stanley F. Battle*