THE UNIVERSITY of NORTH CAROLINA
GREENSBORO

STRATEGIC ENERGY PLAN
ANNUAL UPDATE

SEPTEMBER 2018

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The University of North Carolina at Greensboro (UNCG) has implemented energy efficiency initiatives, a renewable energy installation, and educational programs about the benefits of energy conservation in a concerted effort to reduce energy consumption. Through implementation of the UNC system's first performance contract, installation of several new technologies, improvements to the steam and chilled water infrastructures, and education and outreach efforts, energy and water consumption have decreased significantly since 2003. Overall, UNCG has decreased Energy Use Intensity (EUI) by 18.0%, and the EUI in 2017-18 was the lowest the University has recorded (103,319 Btu/gsf). UNCG has also reduced water consumption per GSF by 74.2% from the FY2002-03 baseline, far surpassing the 20% water savings goal established by the State.

Compared to the previous year, the University registered (-1.055%) reduction in energy EUI and dropped in (-7.23%) campus water consumption. The University by all that reduction had successfully met the energy goal of (-1%) reduction than prior year. The success was not an easy gain considering many challenges with the highest ever listed student's enrollment -an additional 262 FTE- also, the uppermost campus gross square foot ever recorded, and most influenced the extreme winter Greensboro observed when a further 799 heating degree-days developed as to previous year. Part of the campus energy reduction success was tuning up systems at the new constructed student recreation center Leonard J. Kaplan Center for Wellness; all efforts resulted in a significant saving in energy compared to first year of operation. The second year of operation registered 121,888 BTU/GSF, (-11%) lower Energy Use Intensity EUI than first year of operation. Even with that success, efforts will continue to bring the building to a further level of efficiency to meet energy goals. In addition to the EUI reduction, the University registered 19.36 EUI/TDD, reflects a drop in (-12.63) in the Energy Use Intensity per Degree Day. When accounting for the increase in both added square footage and student enrollment, UNCG recorded a great success in reducing energy consumption.

Efforts to reduce UNCG's per square foot energy consumption will continue, guided by the UNCG Climate Action Plan and the Facilities Energy Conservation Team. UNCG will continue to evaluate and implement appropriate technologies and strategies to reduce fossil fuel consumption as funding is available. The ultimate goal is that UNCG will embrace reliable, sustainable energy resources and become a model of campus energy use through innovative energy efficiency, supply, and management programs.

II. FY2017-18 ACCOMPLISHMENTS

UNCG Facilities staff members evaluate energy management efforts by the University on at least a monthly basis. In FY 201-18, several initiatives were introduced or expanded in key strategic focus areas. Highlights include:

- ***Energy Data Management***

  UNCG collects energy consumption and billing information on a monthly basis for all accounts not served directly by utility companies. Currently, meters are read manually and the data analyzed via MS Excel. These data are used to discover trends in energy consumption and identify facilities that warrant more detailed evaluations. UNCG Facilities staff also examine the monthly data to find and correct billing errors and to identify any anomalies in the energy and water consumption of specific facilities.

  Currently, UNCG has 48 buildings on Tridium Building Automation System (BAS), and 12 buildings on older signal GCMs (including Housing and Residence buildings.) The University plans move all its other buildings from the older Signal building automation system to Tridium by the end of FY2018-19. In FY2017-18, the University converted the Sullivan Science Building, 1100 West Market St. Building and Chemical Safety Building from the legacy Signal GCMs (Global Control Modules) to Niagara AX JACEs (Tridium), in addition to Moore Humanities and Research Administration Building that is scheduled from previous year. The Tridium (BAS), allows for better energy analysis and energy management over buildings tied to it.

TVA steam meters were installed in Mossman Building, and Brown Building to fulfill the energy meter's plan for all facilities on campus. The University continues monitoring the fume hood exhaust fans control on six (6) chemistry teaching labs implemented previous fiscal year at the Sullivan Science Building. At the Leonard J. Kaplan Center for Wellness, UNCG continues evaluating the energy performance by comparing over each other two years of operation in terms of energy use and utility cost. The University will continue tracking energy usage in campus buildings and comparing results to find anomalies for better energy management.

- ***Energy Supply Management and Renewables***

Most facilities at UNCG receive electricity from Duke Energy through the main campus substation via an underground medium voltage electrical distribution system. The campus substation is on a time-of-use electricity rate schedule that is reviewed annually to evaluate the best rate options and the incentive programs for which UNCG qualifies.

The primary energy source for the UNCG Steam Plant remains natural gas, with No. 2 fuel oil serving as the backup. Natural gas for the Steam Plant is purchased through State Term Contract 405N, which is currently held by Texican Natural Gas Company, LLC. Use of No. 2 fuel oil not only provides a reliable backup fuel, it also allows UNCG to take advantage of the interruptible gas rate through the term contract. This capability enhances operational flexibility and results in significant cost savings.
The 3.1 kW solar photovoltaic installation on campus has generated over 16 MWh of electricity (approximately 29% of the total electrical consumption of the grounds shop building where it is installed) since it came on-line in late August 2013.

- ***Energy Use in Facilities***

Several campus buildings are governed by a Direct Digital Control (DDC) Building Automation System for heating, ventilating, and air conditioning (HVAC). Temperature set points are established in buildings via the BAS in order to maintain control of adjustments. UNCG reviewed these set points in 2011 and piloted a two-degree change in one building to assess levels of comfort and potential energy savings.

Based on the positive outcomes of the pilot study, coupled with evidence of significant energy savings via similar programs at other universities, UNCG phased in new set points and building occupancy hours starting in December 2011. This program, known as the "Standards of Comfort", established set points as follows:

> **During occupied hours… thermostats will be set at 69-71°F in the heating season, and 74-78°F in the cooling season. During unoccupied hours, the building temperature will be set back at 80°F during the cooling season and at 55-60°F during the heating season. Building occupants are expected to comply with setting the thermostats within these ranges in buildings where thermostats cannot be automatically set by a building automation system (BAS) or other means.**

By June 2013, all campus facilities on the BAS had switched to this new policy. Buildings not on the BAS have also been incorporated into this program, as Facilities staff must manually adjust the settings in these non-BAS buildings each season and install thermostat locks to prevent occupants from changing these settings. All of these legacy buildings in campus have a locked thermostat.
The "Standards of Comfort" program has resulted in avoided costs of almost $1,093,012; avoided electricity consumption of over 15.12 million kWh; and avoided greenhouse gas emissions of 10,630 mtCO2e. The entire policy can be found at: https://facoperations.uncg.edu/wp-content/uploads/2018/02/UNCG_Standards_of_Comfort.pdf

In FY2017-18, the University continued progress in replacing exterior site lighting with LEDs and installing additional site lighting, as needed, at two campus locations Peabody Park and McIver Pedestrian Mall. Foust Park exterior lighting finished when upgrading to LED the last eleven (11) high-pressure sodium poles using the student fee funded Green Fund. In previous two years, the University performed through a contractor and one in-house buildings' retro-

commissioning, and planned to perform a second in-house one to four buildings on campus. The Controls Shop plans to restart commissioning next fiscal year.

UNCG continued for the 10th year the Guaranteed Energy Savings Contract (Performance Contract) for four buildings on campus (Graham Building, Bryan Building, Mossman Building, and Jackson Library) along with the McIver Chiller Plant. Efforts are continued to conduct a second performance contract for UNCG.

- ***New Construction and Renovation***

UNCG established a standard that all new construction meet LEED-NC (Leadership in Energy and Environmental Design) Silver requirements. Currently sixteen (16) buildings on campus have met or exceeded this standard. The LEED-certified spaces on campus have 1,344,035 GSF equivalent to about 20% of the total campus gross square foot; Gold certified accounts for about 35% out of the LEED spaces.

- Jefferson Suites residence hall was completed in 2011 achieved LEED-NC Silver.
- The School of Education building and the seven buildings of the Quad renovation earned LEED-NC Gold.
- In 2014-15, the four new residence halls at Spartan Village and the new Police Station received Silver certification.
- The renovation of the Moran Commons/Dining Hall, completed in July 2015 and received the LEED-NC Silver.
- The Leonard J. Kaplan Center for Wellness (student recreation center) was accepted on June 29 received a Gold LEED Certificate from the U.S. Green Building Council (USGBC).

UNCG also updated its Construction Guidelines in December 2014 to embed many of the best practices found within the LEED-BD+C criteria. Following these Guidelines, the University of North Carolina at Greensboro completed the renovation of 121,522 gross square feet -including Cone Residence Hall- in fiscal year 2017-18. The University Housing and Residence Life received on July 2017 the new constructed Spartan Village II adding two more buildings McCormick and Lexington Residence Halls.

- ***Equipment Efficiency***

UNCG continues its comprehensive maintenance program to maintain and repair equipment to keep it operating efficiently and reliably. The HVAC system preventive maintenance program includes regular filter changes, coil cleaning, and inspections. UNCG also routinely evaluates underground steam lines and performs repairs as necessary to reduce both energy and water consumption.

UNCG maintains guidelines and recommendations based on Energy Star and other criteria to improve equipment efficiency whenever possible. Examples include upgrading motors to higher efficiency models when replaced, installing synchronous belt drives on large exhaust fans, retrofitting light bulbs and lighting fixtures with more efficient models, installing occupancy sensors to control lighting, installing low flow water fixtures, and upgrading constant-volume pumps and fans with Variable Frequency Drives (VFDs) where applicable to achieve energy savings. UNCG continues its multi-year effort to improve the old underground steam and condensate distribution piping. UNCG has a master plan for steam and condensate pipe system improvements and has spent $3 million on those type of improvements since 2008. Phase III between Spring Garden Street and the Mossman Building is completed, and the design for Phase IV between the Elliott University Center and the Bryan Building is completed and Bid through FY2017-18.

At the McIver Chiller Plant, the University implemented controls upgrade and incorporated new variable primary chilled water and condenser water pumping strategy including loop pump control. In addition the University conducted a campus chilled water system building commissioning by calibrating and checking the operation of individual chilled water system at buildings. The University also is planning to rebuild the chiller at Jackson Library chiller plant that exceeded operation hours recommended by the manufacturer. The University has installed CO2

Demand Control Ventilation (DCV) at (6) Air handlers at the Elliott University Center to minimize the outdoor intake air to a minimum demanded level.
The University continued the implementation of retrofit/replacement of fluorescent lamps with Light-Emitting Diode (LED) lamps; Facilities continued with in-house projects at the Music Building (finish the hallways); Sullivan Science (the Auditorium, Classroom 200 & 201, and hallways in all floors); Steam Plant (upper floor); Coleman Building (Research Gym); Mossman Building (lobby); Stone Building (fish lab); Jackson Library (clock tower); and Faculty Center building. Also at Eberhart Building, a contractor converted to LED the two main lecture halls in this facility. In FY2018-19, the University planned to have a capital project to finish converting to LED all lamps at the Sullivan Science building.

- ***Organization Integration***

UNCG entered into a performance contract in 2007 as an alternative to the state funding facility utility upgrades, the first agreement of its kind for a campus in the UNC system. This contract has resulted in significant energy reductions, with an excess of approximately $49,185 in savings over the $798,123 savings guaranteed via the contract last year alone. Since the inception of the performance period of the contract in 2008-09, UNCG has avoided $5.8 million.

The Sustainability Office focused to activate the Climate Action Plan and Green Office program. The office will continue the efforts to support Climate Action Plan workgroup on energy in identifying workplan for year and implementing actions. Deploy newly overhauled voluntary Green Office certification program which includes energy focused behaviors; create and deploy new 'green room recommended program" with bookstore, including items that are high performing in the energy use realm; Overhaul voluntary Green Room certification program for deployment in Fall 2018 (program includes energy focused behaviors).

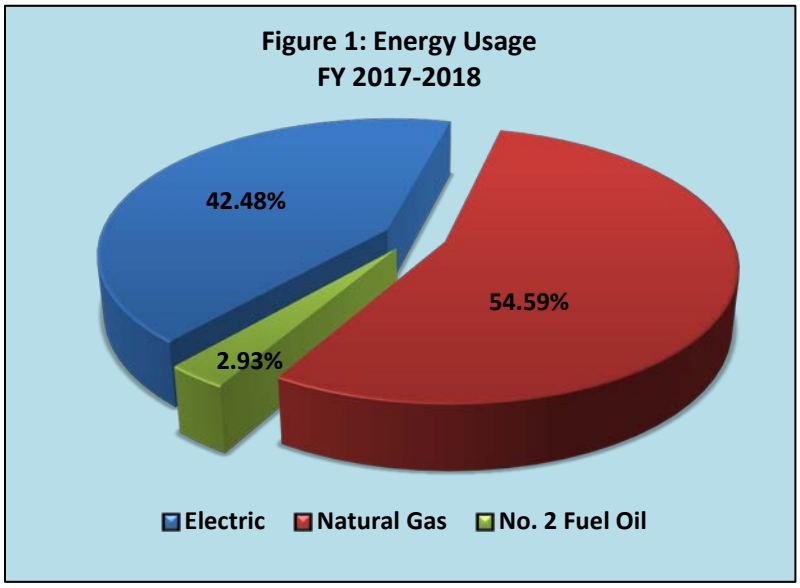
- ***Water Management***

UNCG has made tremendous progress in reducing water consumption. Facilities places special emphasis on leak investigation and underground steam repairs, as well as on identifying and eliminating any wasteful operational practices. Installation of water-conserving fixtures during new construction and renovations has also been implemented. These practices have led to a 74.2% reduction in water consumption (per GSF) since FY2002-03. University staff will continue these successful practices and investigate new technology to curb water consumption, guided in part by strategies laid out in the Climate Action Plan. UNCG continues with water management by data collection from metered irrigation and cooling towers in order to receive non-sewer water credits from the Water Resources Department of the City of Greensboro. The University installed two rainwater harvesting cistern, each with 2,500 gallon at the Ground Shops and 723 Kenilworth Street Building using the student fee funded Green Fund. The collected rainwater is used to irrigate annual plants in the summer and create brine mixtures in the winter.

III. BASELINE UTILITY USE

FY2002-2003 is the baseline year from which UNCG measures its energy and water consumption changes. The Key Performance Indicators (KPIs) used to track utility usage are listed in Section IV (Progress Toward Goals).

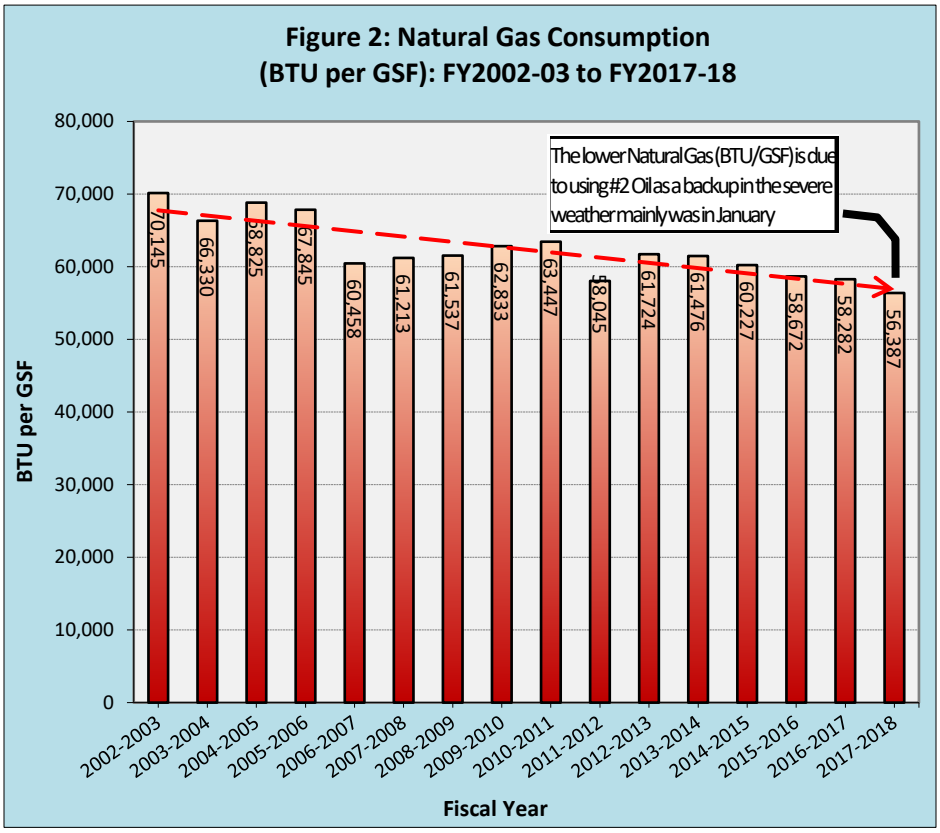
The University's energy usage for the fiscal year 2017-2018 was approximately 54.6% natural gas, 42.48% electricity, and 2.9% No. 2 fuel oil (**Figure 1**). This is similar to the 2016-17 profile, but with an increase in No. 2 fuel oil through winter storms in January 2018 that led to a decrease in natural gas consumption when curtailed.
UNCG's energy usage is broken down into the following categories:



- ***NATURAL GAS***

Piedmont Natural Gas (PNG) provides service through individual meters to the campus and outlying properties. Natural gas is used as fuel for the boilers in the Steam Plant, cooking appliances, and generators. Excepting the Steam Plant, Kaplan Center for Wellness boilers and a few residential complexes, most accounts are small enough that the gas service is provided under PNG's small general service rate or residential rate schedules. Complying with the N.C. Gen. Stat. § 105-164.13(52) which provides tax exemption to a State agency accounts. Starting July 2017, Piedmont Natural Gas exempted from tax all the accounts the University has including the new added in last fiscal year.

Natural gas for the Steam Plant is purchased through State Term Contract 405N, which is currently held by Texican Natural Gas Company, LLC.

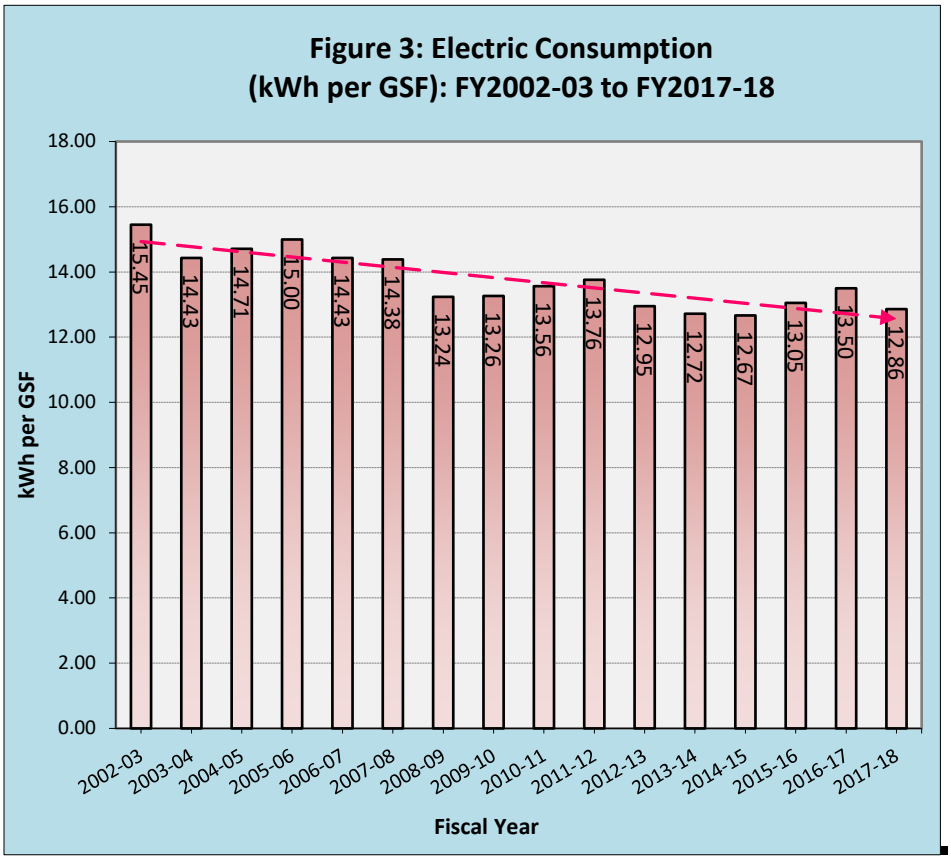


In fiscal year 2017-2018, consumption per GSF decreased by 3.25% versus the previous year (**Figure 2**). The University's total natural gas bill was $1,936,820 for 368,273 MMBTUs, representing a reduction by 1.40% in total consumption compared to FY2017-18, and a reduction by 2.70 % in costs.

- ***ELECTRICITY***

Duke Energy provides electric power to UNCG facilities through 105 accounts. Out of the total accounts with Duke, 48 accounts are for the Lofts on Lee and Spartan Village I & II on West Gate City Blvd. Others are for either leases for public lighting or for power to very small, dispersed loads such as irrigation systems, emergency phones, and entrance signs. An additional 15 accounts are for houses or offices not located on the campus. Also through FY2017-18, UNCG added five (5) accounts for buildings included to the campus.

By far the largest account is for the main campus distribution system. The main campus receives power at a central substation that feeds an underground medium voltage electrical distribution system connected to more than 60 buildings. All of these buildings have electricity submeters that are read monthly and the values manually entered into a database.



In FY2017-18, the total electricity bill for the campus was $5,276,395 for 83.99 million kWhs. Compared to FY2016-17, this represents a drop by 3.04% in total costs, and 2.91% in total electrical consumption. That noteworthy electricity reduction is due to promoting a more efficient control over systems in the new constructed recreation center, and also, due to the previous year project when implemented based on time of use control the exhaust fans (previously were constant run) in six chemistry teaching labs in the Sullivan Science Building, in addition to all other applied energy conservation measures. The change on kWh/gsf basis, the electrical use also decreased by 4.73% to 12.86 kWh/gsf from 13.50 in prior year (**Figure 3**). To further reduce costs, Duke Energy performs a best rate analysis yearly for all of the electricity accounts. From January to December 2017, UNCG avoided over $687,516 (13.03%) of increased costs compared to the next best alternative rate.

- ***FUEL OIL***

The Steam Plant is capable of using No. 2 fuel oil as a backup fuel to natural gas. This provides the University with an emergency fuel source and allows Piedmont Natural Gas (PNG) to interrupt natural gas service to the campus during times of peak gas demand. The ability to have gas service interrupted allows the University to purchase gas at a lower rate. PNG has needed to interrupt service to the University several times in the past, this backup energy source has proven very beneficial. In FY2017-18, UNCG used 142,509 gallons of No. 2 fuel oil at the Steam Plant, very intense compared to previous year mainly due to the two curtailment periods happened in January 2018.

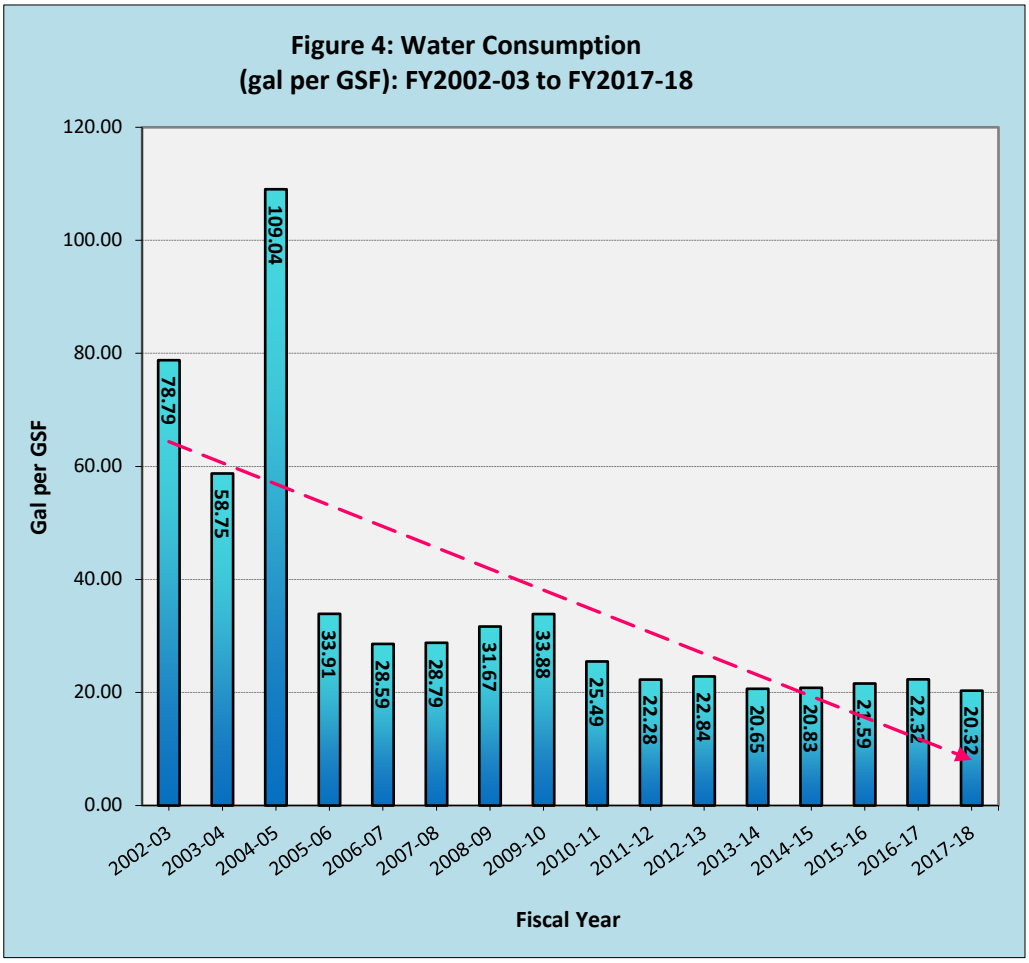
▪ *STEAM AND CHILLED WATER*

The University uses purchased power and natural gas to create steam and chilled water that are distributed to the campus. Steam goes to over 60 buildings on the main campus where it is used for climate control, humidification, and domestic water heating. The central chiller plant produces chilled water that serves HVAC needs in 41 buildings. Most buildings do not have a steam meter or chilled water meter; however, the University has developed a comprehensive Campus Metering Plan to install steam meters and chilled water meters in all buildings.

In 2017-18, the Steam Plant produced 286,955,000 lbs. of steam, using 3.36 million gallons of make-up water. These represent 3% more steam production, and 10% more make-up water consumption when compared to FY 2016-17.

▪ *WATER*

UNCG receives water and sewer service from the City of Greensboro. The University owns a distribution system that receives water through three (3) City master meters and distributes it to over 60 buildings. UNCG also has water service for several outlying properties as well. Most buildings on campus have UNCG-owned water meters that are read and manually entered into a database. Where water is used for irrigation or cooling towers, submeters have been installed so that the University can calculate non-sewer credits for water that does not enter the sanitary sewer system and receive appropriate reimbursement from the City of Greensboro.



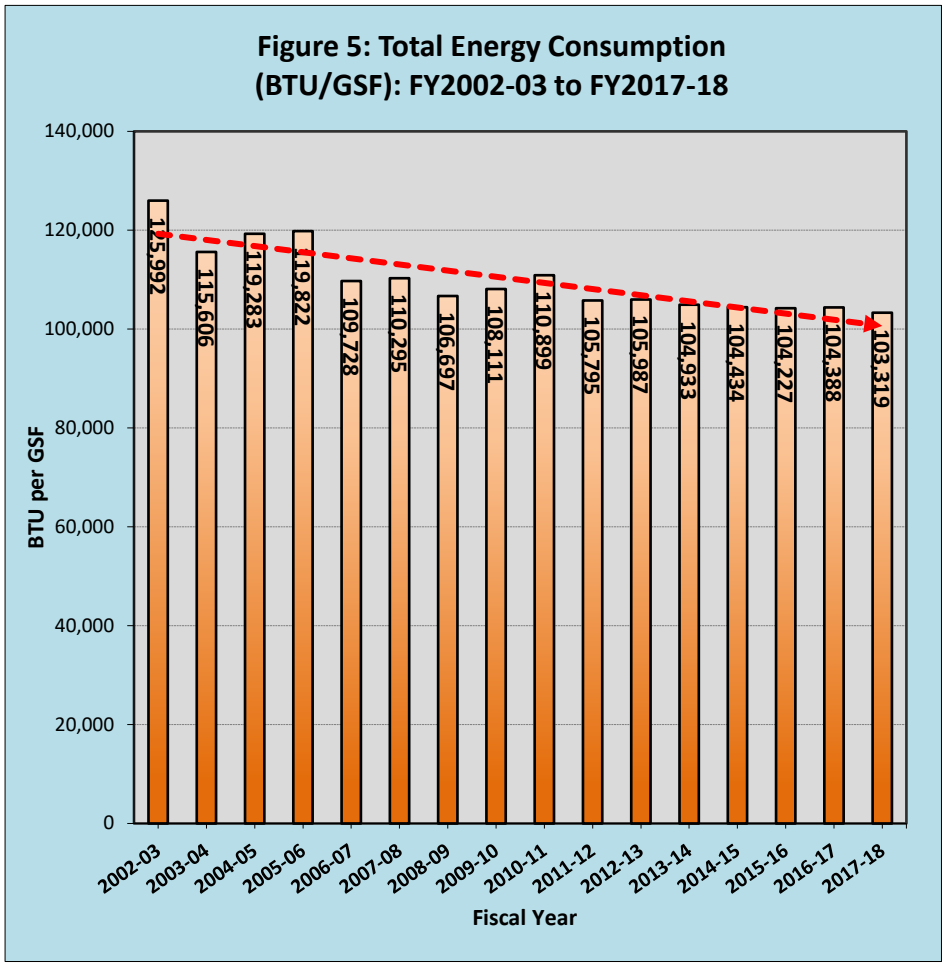
In fiscal year 2017-2018, UNCG water accounts totaled $1,099,897 for 132 million gallons of water. Total consumption is **dropped** 7.23% (10.3 million gallons) over FY2016-17; the decrease was 8.97% when analyzing consumption per gross square foot (**Figure 4**). UNCG also claimed non-sewer water credits in 2017-18 for approximately 50.04 million gallons of water. These credits allowed UNCG to avoid more than $239,277 in water charges.

IV. PROGRESS TOWARD GOALS

The primary goals of this Strategic Energy Plan are to decrease UNCG's total energy and water consumption to meet the respective State-mandated reductions. Key Performance Indicators include:

- *Total Energy Consumption per Square Feet (BTU/GSF)*
- *Total Energy Consumption per Student (BTU/FTE)*
- *Electricity Use per Square Feet (kWh/GSF)*
- *Water Use per Square Feet (Gal/GSF)*
- *Natural Gas Use per Square Feet (BTU/GSF)*

Energy: The primary metrics used to evaluate progress are Total Energy Consumption (BTU) per Gross Square Foot (GSF) and per Student (FTE). Using FY2002-03 as a baseline, total energy consumption per GSF has **decreased** 18.0%, more than half of the reduction necessary to meet the State's goal. Total energy consumption per GSF decreased 1.02% than FY16-17 (**Figure 5**).



Results of total energy consumption per FTE show 37,172,504 BTU/FTE a **decrease** in 0.58% over 2016-17 (**Figure 6**). Though Fall 2017 listed the highest ever enrollment 18,153 FTE and the additional campus GSF for the new recreation center (256,236 gsf), and 626 more total degree-days in 2017-18 were an indicator to the great achievement of registering that reduction in energy consumption per FTE (see **Figure 6**). Energy cost per FTE has dropped through FY2017-18; the campus energy cost per FTE dropped 0.29% to be at $414.36/student. The drop was even with an increase in the Natural Gas and Water unit cost.

Water: Through FY2017-18, UNCG has reduced water consumption (per GSF) **by 74.2% since 2002-03,** far exceeding the mandated 20% reduction. Considering the highest enrollment ever recorded by the campus, the water consumption based on square footage in 2017-18 was the **lowest ever** since the baseline was established (**Figure 4**).

Weather Effects: FY2017-18 observed a severe winter and milder summer compared to FY2016-17. The total number of degree-days in FY2017-18 was 13% more than those in previous fiscal year with 626 additional degree-days. Broken out by season, 2017-18 saw a drop 173 in CDD, with 799 more HDD. Factoring in this weather variable reveals that the increase in the total TDD for the FY2017-18 caused the energy use intensity (BTU/GSF/TDD) to decrease by 12.6% compared to FY2016-17. (**Figure 7**).

NOTE: For other graphs detailing UNCG's utility consumption data, please see the Appendices.

Figure 6: Total Energy Consumption (BTU/FTE): FY2002-03 to FY2017-18

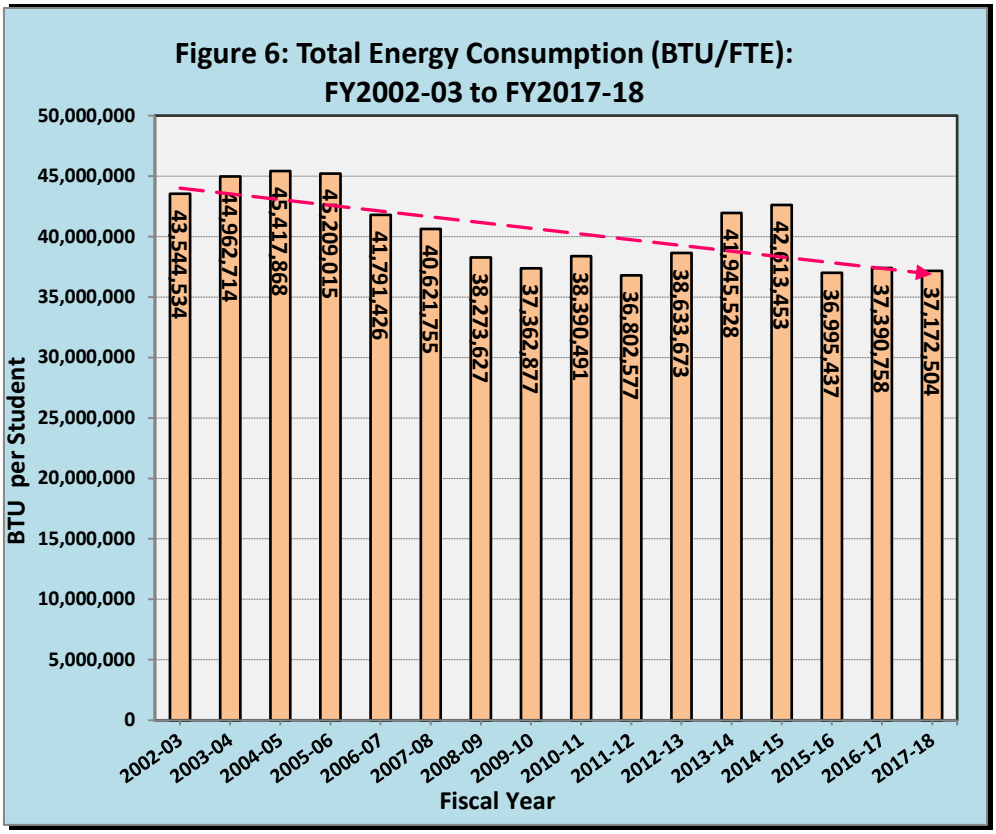
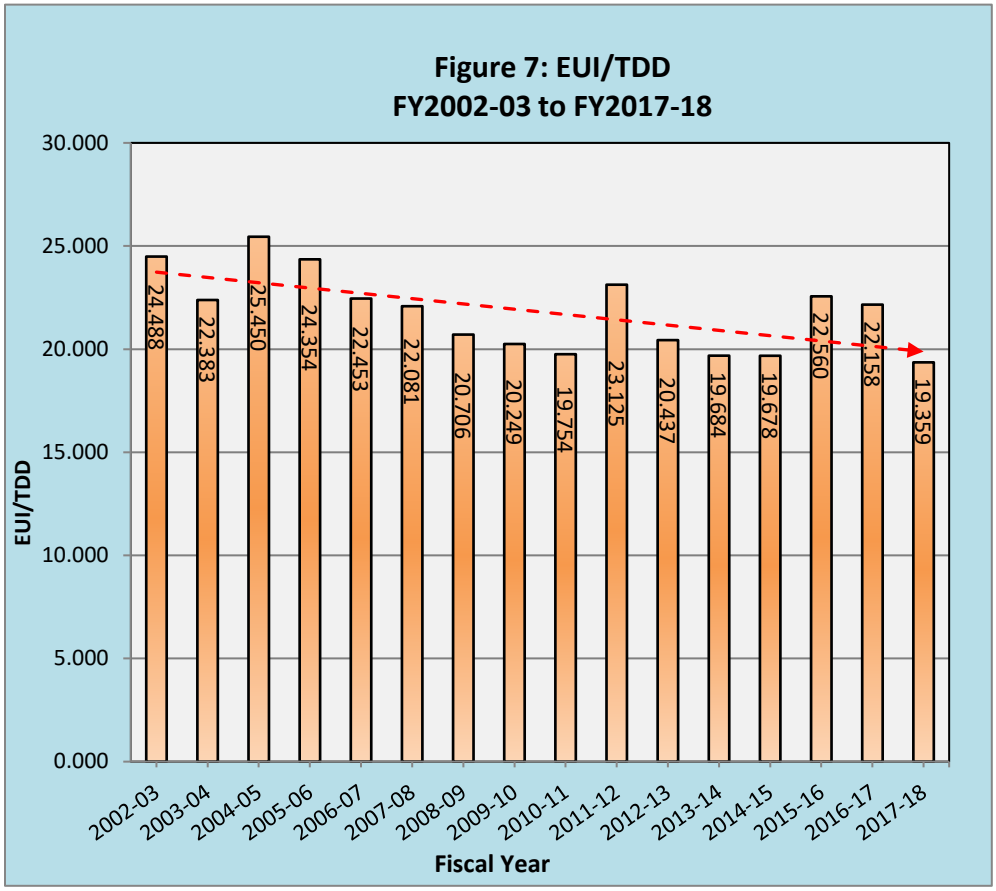


Figure 7: EUI/TDD FY2002-03 to FY2017-18

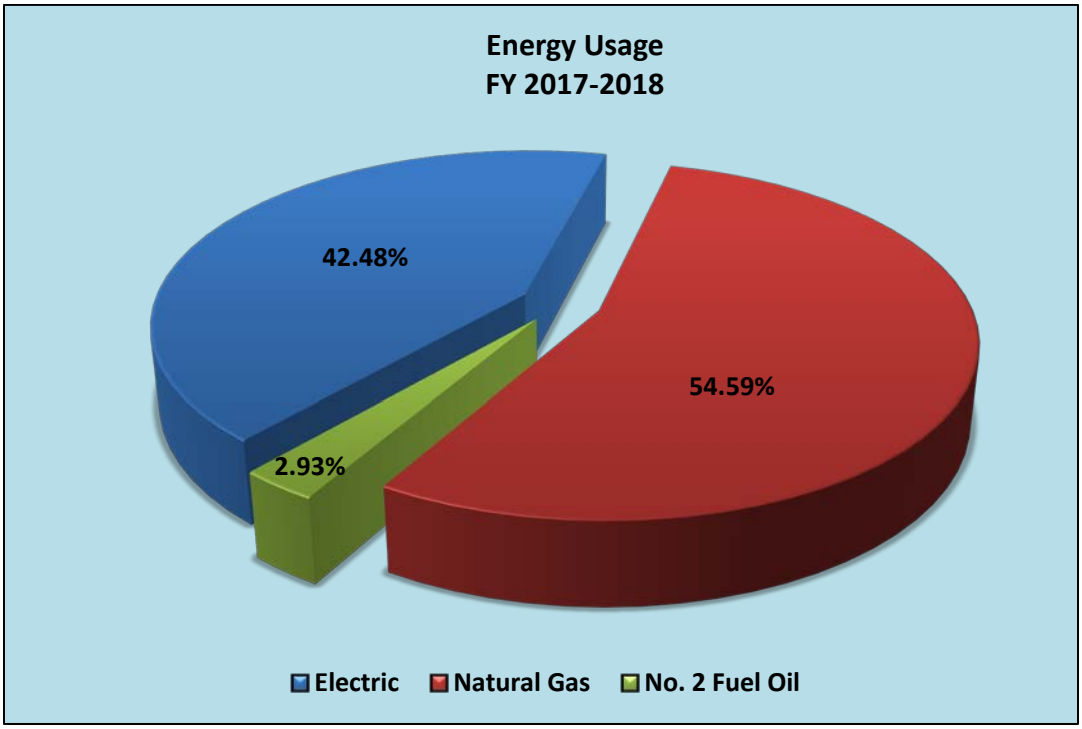


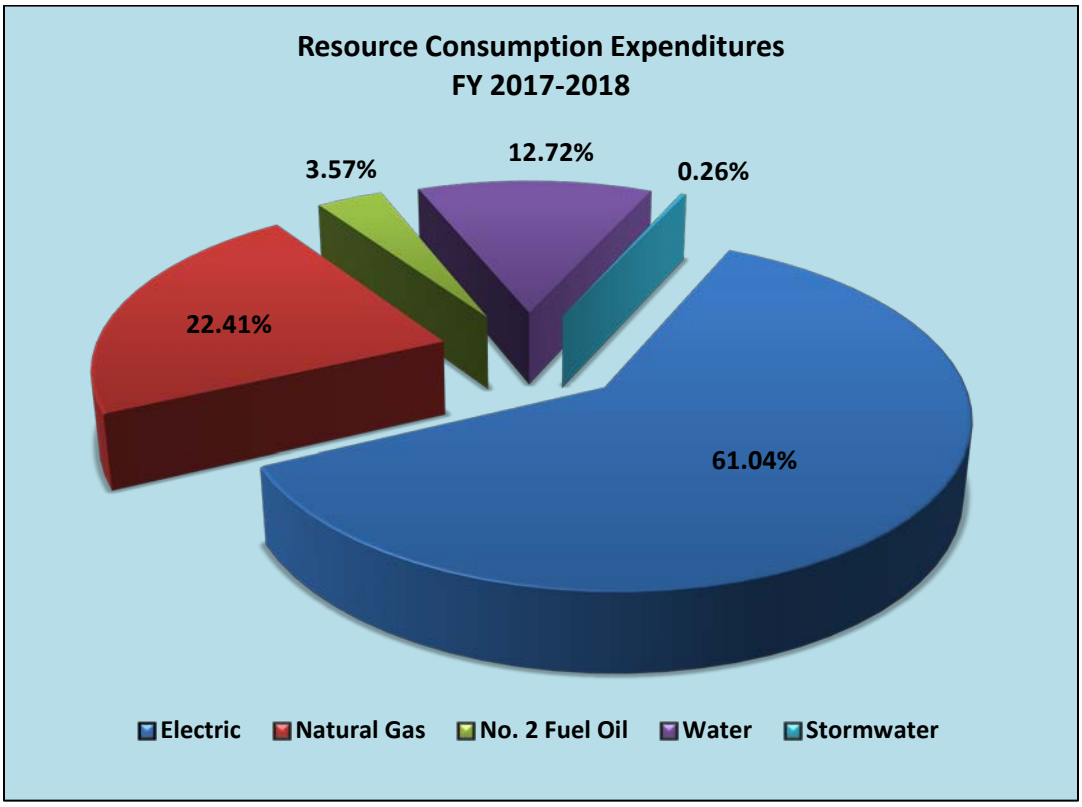
V. FUTURE ENERGY MANAGEMENT

Despite the budgetary issues facing the UNC system, UNCG continues to invest in and promote energy conservation. The University has incorporated several technical and operational upgrades, and launched or expanded programs to encourage resource conserving habits across the campus. Implementation of the UNCG Climate Action Plan to reduce energy consumption and eliminate greenhouse gas emissions began in the Fall of 2013. These and all other efforts keep UNCG moving towards the 2050 carbon neutrality directive even though the 2015 energy reduction mandate has not been met. Utility Savings Carry Forward funds (HB1292 / General Statute 143-64.12(a)) will continue to be invested in energy conservation measures throughout State -supported campus facilities.

VI. APPENDICES

Appendix A
Utility Consumption and Costs





Appendix B
Utility Consumption Analyses

The University of North Carolina at Greensboro

Appendix B1

FISCAL YEAR	TOTAL ENERGY (KWH)	% CHANGE	TOTAL ENERGY (MMBTU)	CAMPUS AREA (GSF)*	% CHANGE (GSF)	STUDENT POPULATION **(FTE)	% CHANGE
1999-2000	137,927,885	-	470,688	3,785,926	-	11,375	-
2000-01	143,521,857	4.06	490,226	3,838,194	1.38	11,250	-1.10
2001-02	142,712,609	-0.56	487,029	3,888,068	1.30	11,746	4.41
2002-03	157,607,223	10.44	537,949	4,269,699	9.82	12,354	5.18
2003-04	167,435,872	6.24	571,386	4,942,520	15.76	12,708	2.87
2004-05	174,331,841	4.12	594,929	4,987,544	0.91	13,099	3.08
2005-06	181,808,340	4.29	620,403	5,177,689	3.81	13,723	4.76
2006-07	174,131,771	-4.22	594,232	5,415,496	4.59	14,219	3.61
2007-08	173,886,580	-0.14	597,302	5,415,496	0.00	14,704	3.41
2008-09	169,320,720	-2.63	577,817	5,415,496	0.00	15,097	2.67
2009-10	171,525,035	1.30	585,476	5,415,496	0.00	15,670	3.80
2010-11	179,050,978	4.39	615,630	5,551,245	2.51	16,036	2.34
2011-12	170,745,895	-4.64	582,990	5,510,548	-0.73	15,841	-1.22
2012-13	177,419,943	3.91	605,902	5,716,735	3.74	15,683	-1.00
2013-14	184,475,879	3.98	629,539	5,999,437	4.95	15,009	-4.30
2014-15	186,236,059	0.95	635,590	6,086,061	1.44	14,915	-0.62
2015-16	188,241,831	1.08	642,435	6,163,784	1.28	17,365	16.43
2016-17	196,028,558	4.14	668,958	6,408,406	3.97	17,891	3.03
2017-18	197,692,442	0.85	674,792	6,531,155	1.92	18,153	1.46

1 Therm = 29.3 kWh
1 Gallon #2 Fuel Oil = 40.7 kWh

9/4/2018

* - (GSF from UNCG Space Mgt)
** - (From UNCG Inst. Res. Office Factbook)

The University of North Carolina at Greensboro

Appendix B1

FISCAL YEAR	TOTAL ENERGY (KWH/GSF)	% CHANGE	TOTAL ENERGY (BTU/GSF)	BTU per GSF per HDD	BTU per GSF per CDD	HDD	CDD
1999-2000	36.43	-	124,326	37	86	3368	1448
2000-01	37.39	2.64	127,723	32	100	3951	1279
2001-02	36.71	-1.84	125,262	38	91	3276	1380
2002-03	36.91	0.57	125,992	34	89	3730	1415
2003-04	33.88	-8.23	115,606	32	77	3664	1501
2004-05	34.95	3.18	119,283	35	91	3371	1316
2005-06	35.11	0.46	119,822	37	70	3203	1717
2006-07	32.15	-8.43	109,728	34	68	3273	1614
2007-08	32.11	-0.14	110,295	36	58	3103	1892
2008-09	31.27	-2.63	106,697	30	69	3606	1547
2009-10	31.67	1.30	108,111	30	64	3640	1699
2010-11	32.25	1.83	110,899	30	58	3696	1918
2011-12	30.99	-3.93	105,795	37	62	2865	1710
2012-13	31.04	0.16	105,987	29	70	3666	1520
2013-14	30.75	-0.92	104,933	27	71	3851	1480
2014-15	30.60	-0.48	104,434	28	66	3726	1581
2015-16	30.54	-0.20	104,227	35	62	2938	1682
2016-17	30.59	0.16	104,388	37	54	2,786	1925
2017-18	30.27	-1.05	103,319	29	59	3,585	1752

1 Therm = 29.3 kWh
1 Gallon #2 Fuel Oil = 40.7 kWh

9/4/2018

* - (GSF from UNCG Space Mgt)
** - (From UNCG Inst. Res. Office Factbook)

The University of North Carolina at Greensboro

Appendix B1

FISCAL YEAR	TDD	EUI/TDD	BTU per STUDENT	% CHANGE	TOTAL ENERGY ($)	% CHANGE	COST per GSF ($)	COST per STUDENT ($)
1999-2000	4816	25.815	41,379,137	-	3,916,913	-	1.03	344.344018
2000-01	5230	24.421	43,575,627	5.31%	4,810,563	22.82	1.25	427.61
2001-02	4656	26.903	41,463,392	-4.85%	6,110,962	27.03	1.57	520.26
2002-03	5145	24.488	43,544,534	5.02%	4,953,663	-18.94	1.16	400.98
2003-04	5165	22.383	44,962,714	3.26%	5,528,107	11.60	1.12	435.01
2004-05	4687	25.450	45,417,868	1.01%	6,251,452	13.08	1.25	477.25
2005-06	4920	24.354	45,209,015	-0.46%	7,685,754	22.94	1.48	560.06
2006-07	4887	22.453	41,791,426	-7.56%	7,041,951	-8.38	1.30	495.25
2007-08	4995	22.081	40,621,755	-2.80%	7,602,526	7.96	1.40	517.04
2008-09	5153	20.706	38,273,627	-5.78%	6,872,383	-9.60	1.27	455.22
2009-10	5339	20.249	37,362,877	-2.38%	6,535,847	-4.90	1.21	417.09
2010-11	5614	19.754	38,390,491	2.75%	6,753,156	3.32	1.22	421.12
2011-12	4575	23.125	36,802,577	-4.14%	6,716,483	-0.54	1.22	423.99
2012-13	5186	20.437	38,633,673	4.98%	6,948,523	3.45	1.22	443.05
2013-14	5331	19.684	41,945,528	8.57%	7,242,651	4.23	1.21	482.57
2014-15	5307	19.678	42,613,453	1.59%	6,959,803	-3.91	1.14	466.62
2015-16	4620	22.560	36,995,437	-13.18%	6,783,434	-2.53	1.10	390.63
2016-17	4711	22.158	37,390,758	1.07%	7,435,123	9.61	1.16	415.58
2017-18	5337	19.359	37,172,504	-0.58%	7,521,794	1.17	1.15	414.36

1 Therm = 29.3 kWh
1 Gallon #2 Fuel Oil = 40.7 kWh

9/4/2018

* - (GSF from UNCG Space Mgt)
** - (From UNCG Inst. Res. Office Factbook)

The University of North Carolina at Greensboro

YEAR	TOTAL	AVERAGE	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
	(HDD)	(Monthly)												
1999-2000	3368	280.67	6	0	31	236	341	671	856	575	354	264	29	5
2000-2001	3951	329.25	0	0	62	165	546	984	809	553	584	209	39	0
2001-2002	3276	273.00	0	0	61	248	303	582	720	624	471	162	105	0
2002-2003	3730	310.83	0	0	1	217	495	782	877	692	369	207	85	5
2003-2004	3664	305.33	0	0	22	206	331	792	871	758	428	224	32	0
2004-2005	3371	280.92	0	1	7	131	379	720	690	590	553	212	78	10
2005-2006	3203	266.92	0	0	3	162	397	791	568	629	428	135	90	0
2006-2007	3273	272.75	0	0	31	253	398	574	663	729	319	239	64	3
2007-2008	3103	258.58	0	0	7	91	437	556	775	570	414	214	39	0
2008-2009	3606	300.50	0	0	14	239	543	626	837	604	497	199	47	0
2009-2010	3640	303.33	0	0	14	205	375	800	890	791	421	109	35	0
2010-2011	3696	308.00	0	0	4	123	449	980	910	543	474	163	50	0
2011-2012	2865	238.75	0	0	20	224	382	565	685	562	208	196	19	4
2012-2013	3666	305.50	0	0	18	213	557	561	691	686	646	196	98	0
2013-2014	3851	320.92	0	2	14	164	563	643	975	642	631	184	33	0
2014-2015	3726	310.50	0	0	17	152	588	654	825	870	431	164	21	4
2015-2016	2938	244.83	0	0	7	183	335	369	866	652	270	188	68	0
2016-2017	2786	232.17	0	0	0	90	354	689	651	391	441	118	51	1
2017-2018	3585	298.75	0	0	23	140	470	735	922	425	606	261	3	0

Source: NOAA/National Weather Service

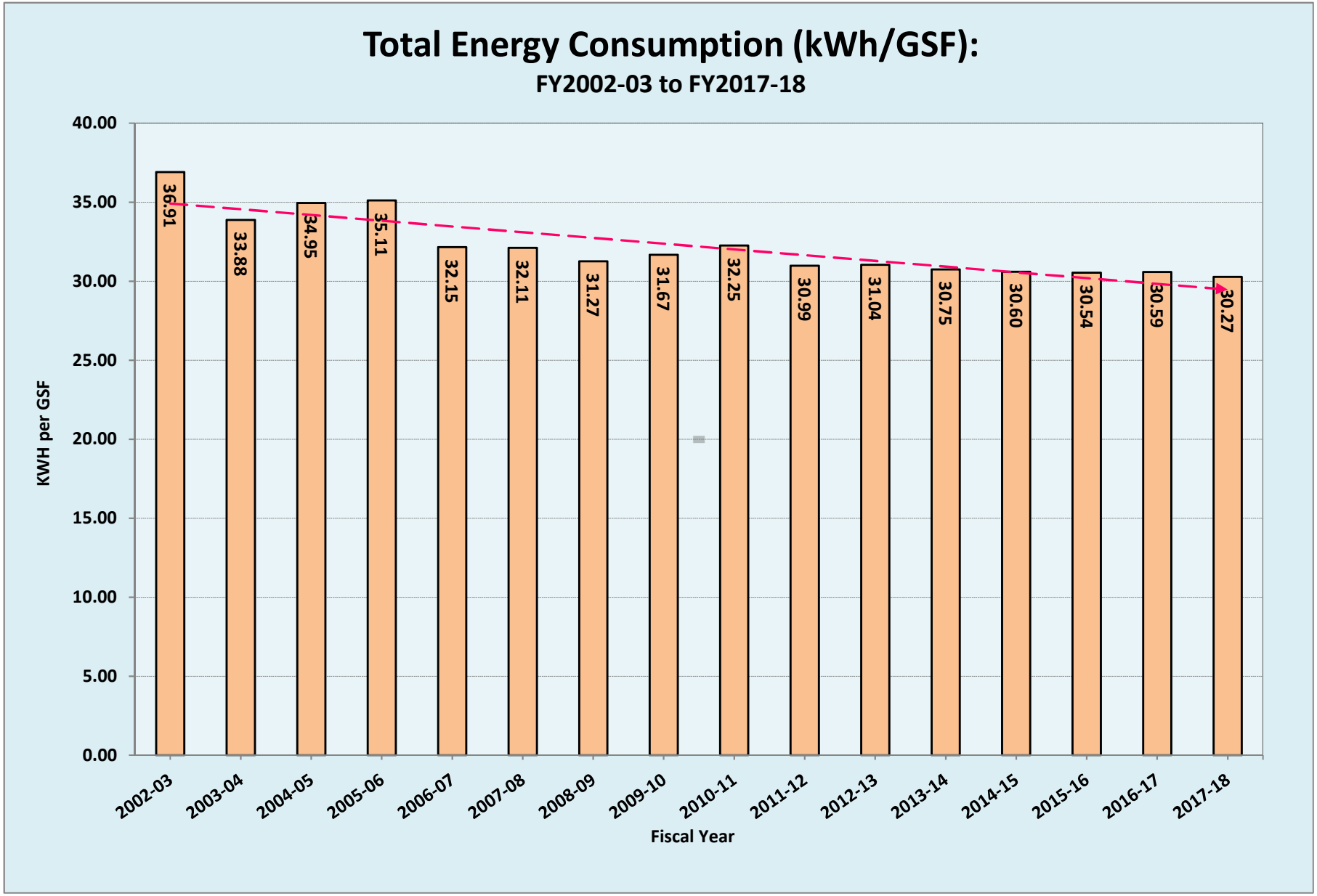
Heating Degree Days (Base 65 Degrees F)

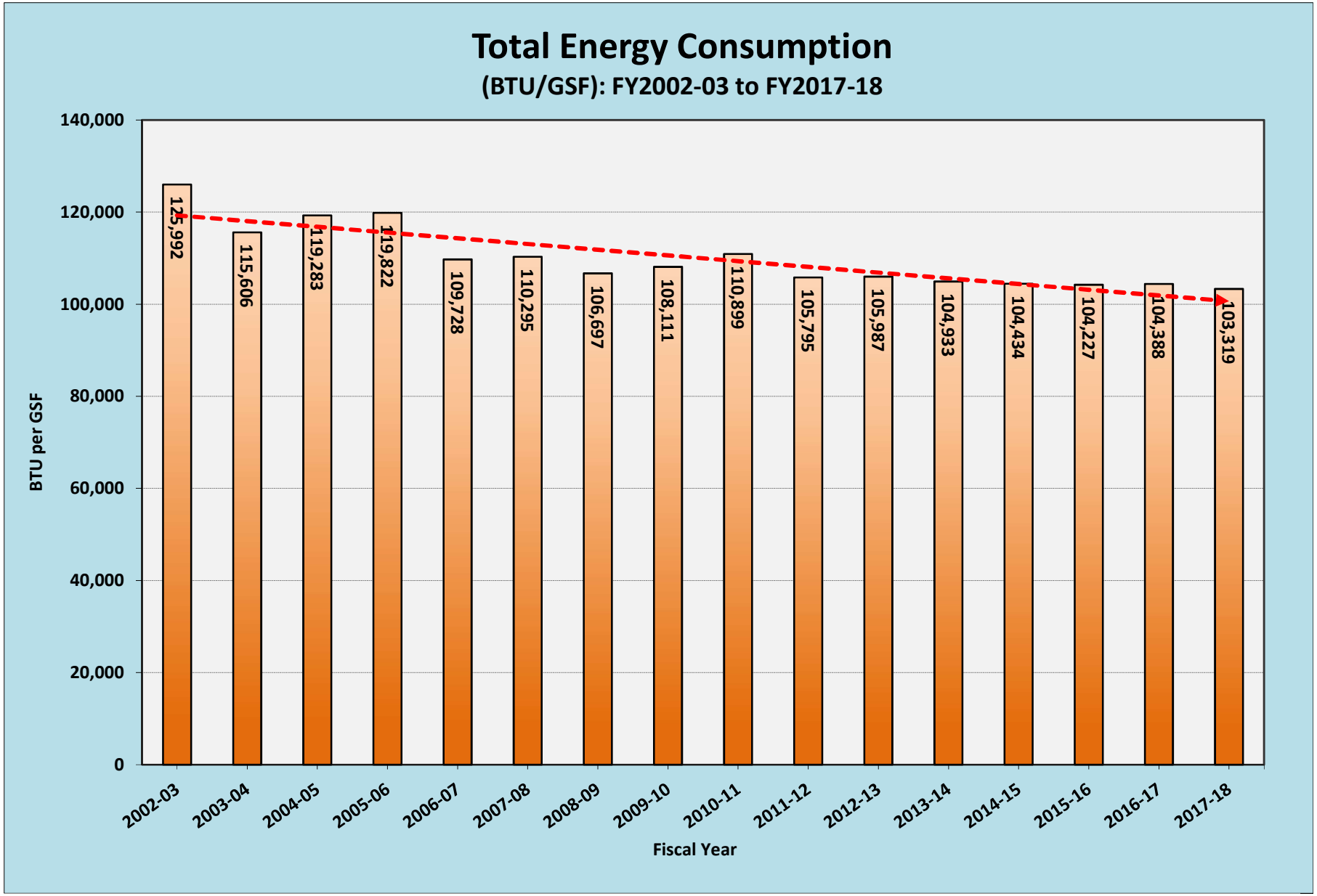
The University of North Carolina at Greensboro

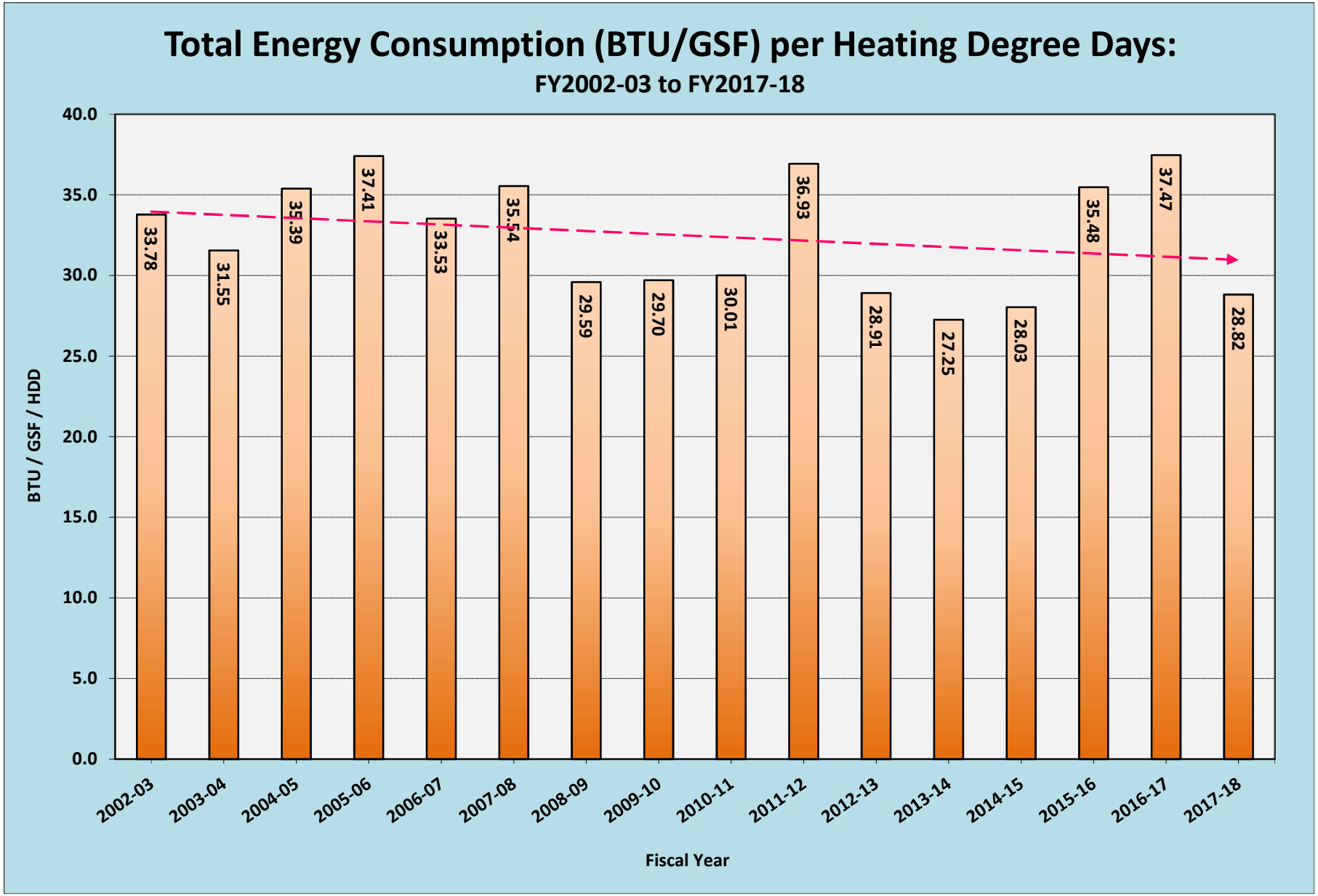
YEAR	TOTAL	AVERAGE	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
	(CDD)	(Monthly)												
1999-2000	1448	120.67	434	396	124	13	0	0	0	0	6	9	152	314
2000-2001	1279	106.58	329	331	134	24	2	0	0	0	0	57	87	315
2001-2002	1380	115.00	304	379	137	18	5	0	1	0	2	82	127	325
2002-2003	1415	117.92	440	375	214	72	0	0	0	0	6	18	69	221
2003-2004	1501	125.08	350	394	142	6	17	0	0	0	7	42	245	298
2004-2005	1316	109.67	415	316	173	28	10	0	0	0	0	17	58	299
2005-2006	1717	143.08	468	453	274	62	4	0	0	0	10	64	98	284
2006-2007	1614	134.50	434	455	135	21	2	0	0	0	38	48	162	319
2007-2008	1892	157.67	381	572	279	131	0	3	0	0	1	17	84	424
2008-2009	1547	128.92	420	368	198	23	0	0	0	0	8	36	158	336
2009-2010	1699	141.58	368	432	169	14	0	0	0	0	0	52	215	449
2010-2011	1918	159.83	500	463	296	38	0	0	0	0	8	61	155	397
2011-2012	1710	142.50	503	444	209	9	4	0	0	0	26	33	199	283
2012-2013	1520	126.67	510	364	175	26	0	0	0	0	0	35	113	297
2013-2014	1480	123.33	399	309	168	49	0	7	0	0	0	21	174	353
2014-2015	1581	131.75	380	313	197	43	0	0	0	0	2	32	196	418
2015-2016	1682	140.17	468	392	229	16	3	14	0	0	25	49	121	365
2016-2017	1925	160.42	521	478	338	55	12	0	0	3	8	88	132	290
2017-2018	1752	146.00	470	355	186	70	1	0	0	7	2	8	266	387

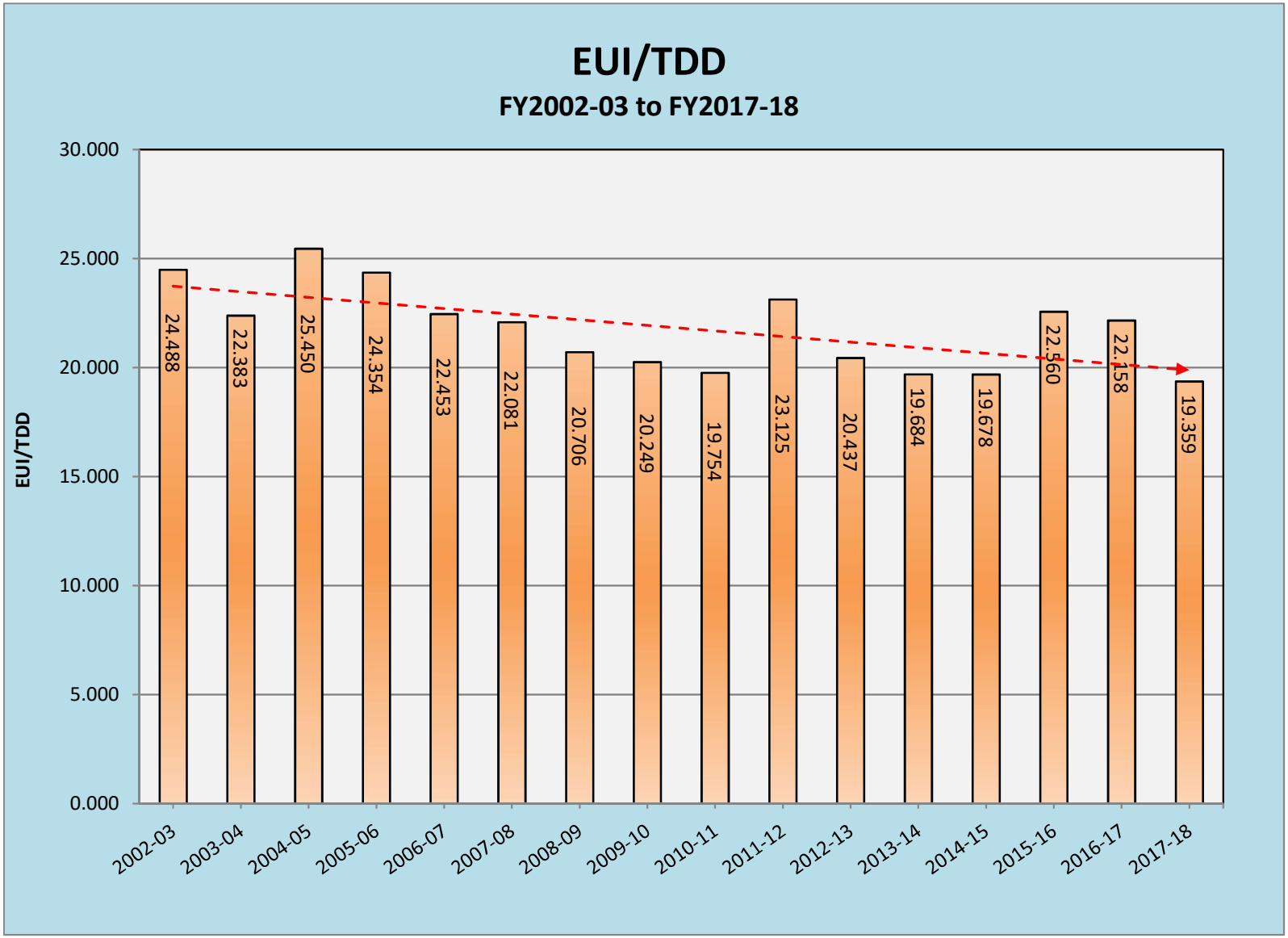
Source: NOAA/National Weather Service

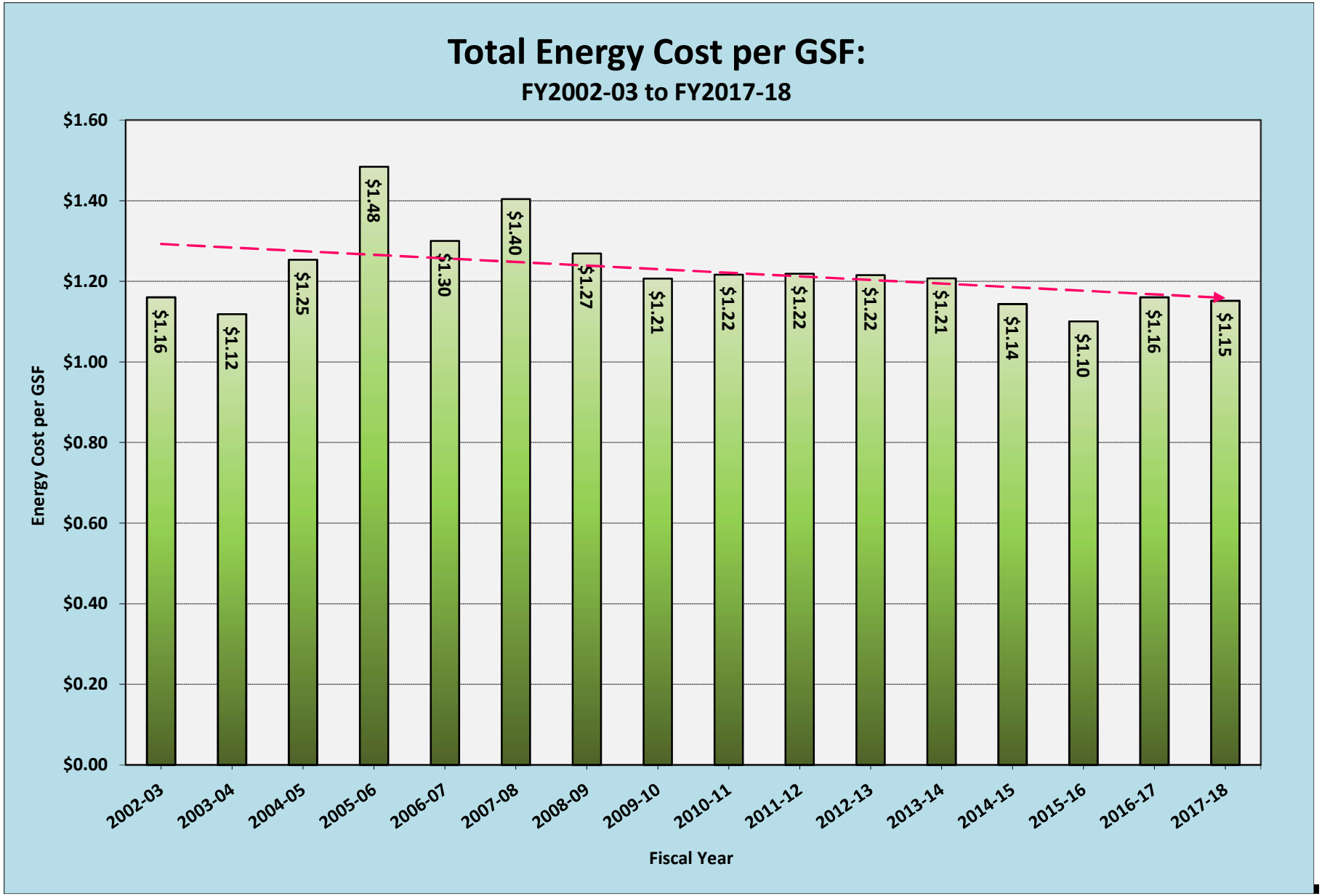
Cooling Degree Days (Base 65 Degrees F)

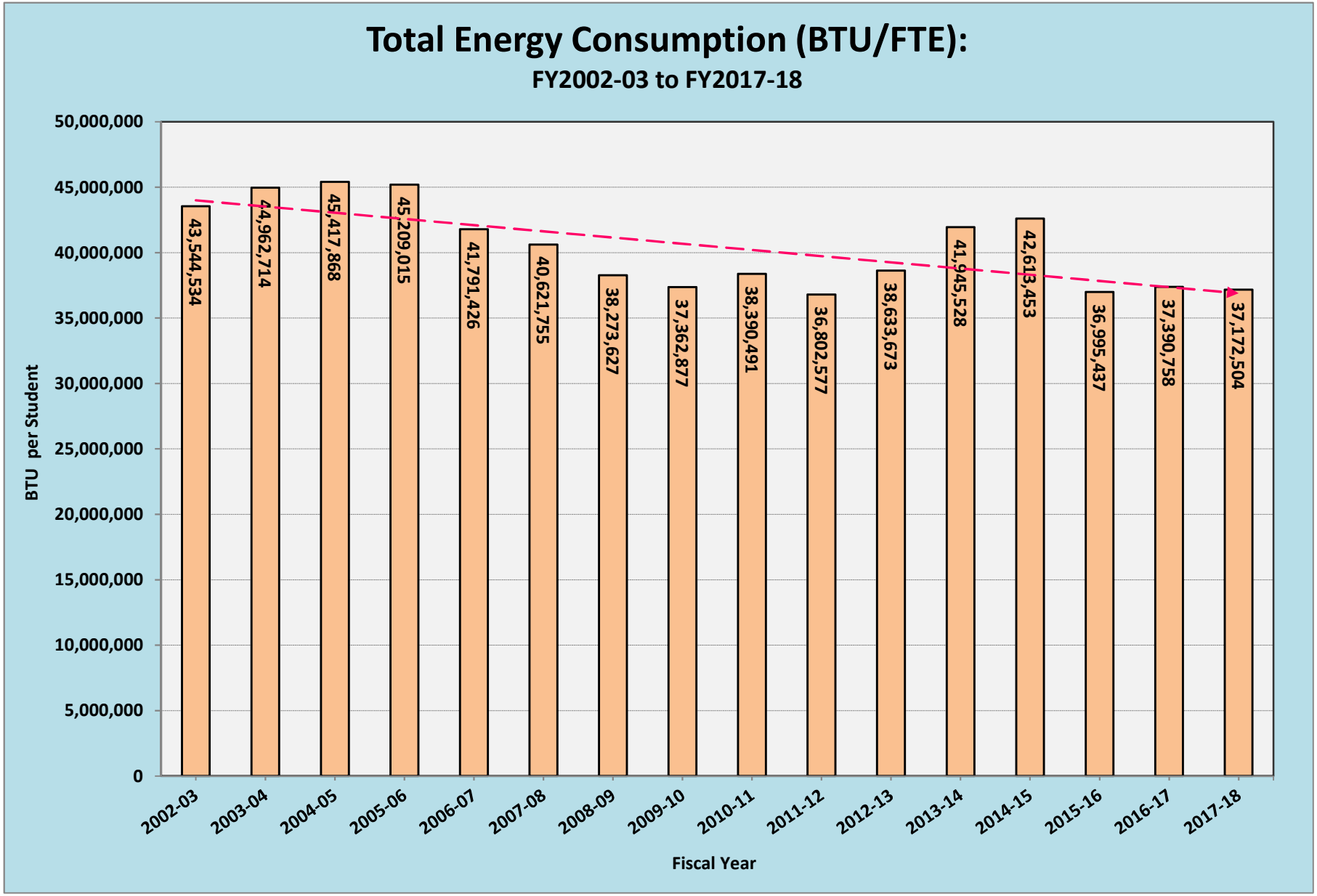

Total Energy Consumption (kWh/GSF):
FY2002-03 to FY2017-18
KWH per GSF
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
36.91
33.88
34.95
35.11
32.15
32.11
31.27
31.67
32.25
30.99
31.04
30.75
30.60
30.54
30.59
30.27
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year

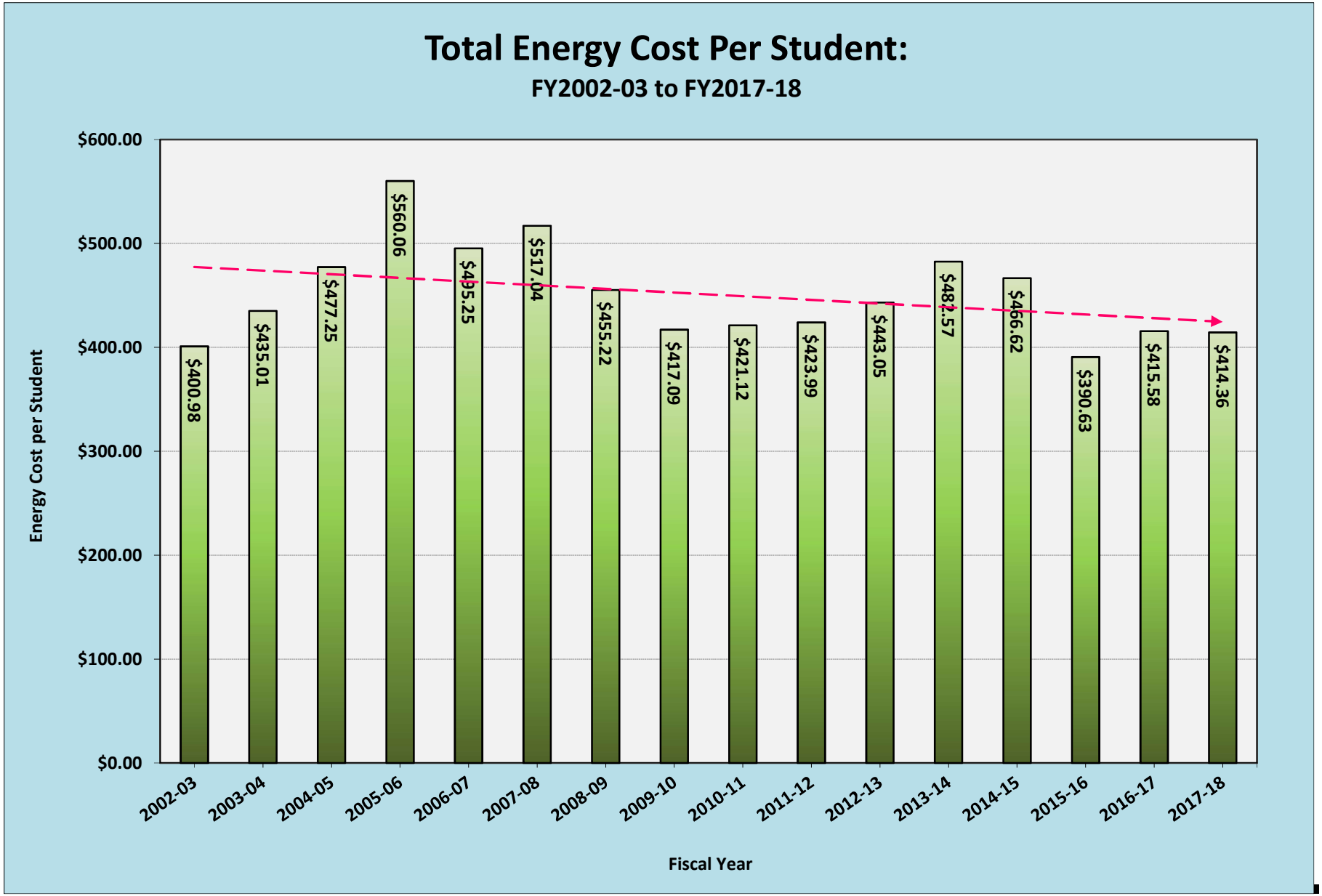

Total Energy Consumption
(BTU/GSF): FY2002-03 to FY2017-18
BTU per GSF
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
125,992
115,606
119,283
119,822
109,728
110,295
106,697
108,111
110,899
105,795
105,987
104,933
104,434
104,227
104,388
103,319
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year

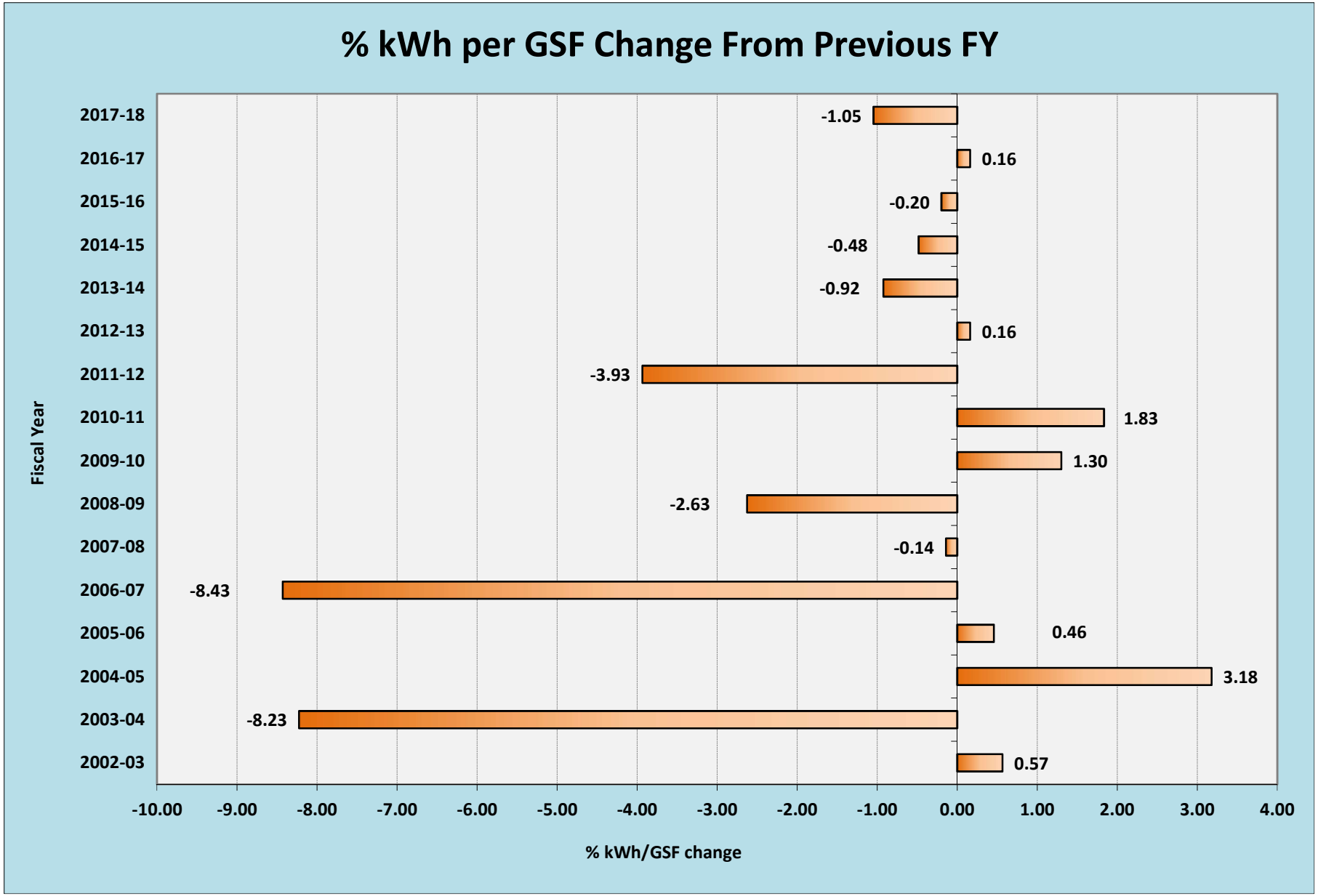

Total Energy Consumption (BTU/GSF) per Heating Degree Days:
FY2002-03 to FY2017-18
BTU / GSF / HDD
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
33.78
31.55
35.39
37.41
33.53
35.54
29.59
29.70
30.01
36.93
28.91
27.25
28.03
35.48
37.47
28.82
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year

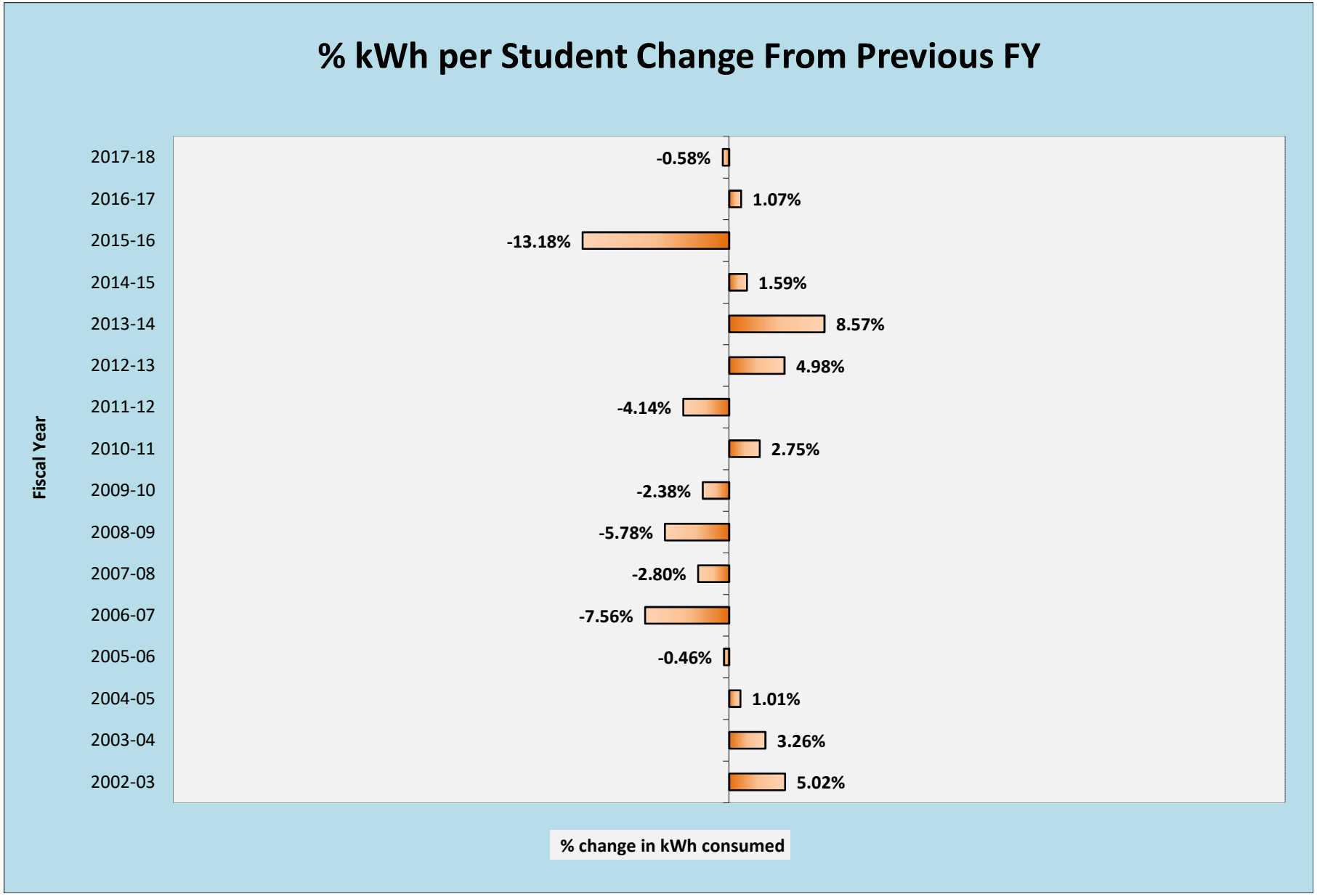

EUI/TDD
FY2002-03 to FY2017-18
EUI/TDD
30.000
25.000
20.000
15.000
10.000
5.000
0.000
24.488
22.383
25.450
24.354
22.453
22.081
20.706
20.249
19.754
23.125
20.437
19.684
19.678
22.560
22.158
19.359
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18


Total Energy Cost per GSF:
FY2002-03 to FY2017-18
Energy Cost per GSF
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
$1.16
$1.12
$1.25
$1.48
$1.30
$1.40
$1.27
$1.21
$1.22
$1.22
$1.22
$1.21
$1.14
$1.10
$1.16
$1.15
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year


Total Energy Consumption (BTU/FTE):
FY2002-03 to FY2017-18
BTU per Student
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
43,544,534
44,962,714
45,417,868
45,209,015
41,791,426
40,621,755
38,273,627
37,362,877
38,390,491
36,802,577
38,633,673
41,945,528
42,613,453
36,995,437
37,390,758
37,172,504
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year


Total Energy Cost Per Student:
FY2002-03 to FY2017-18
Energy Cost per Student
$600.00
$500.00
$400.00
$300.00
$200.00
$100.00
$0.00
$400.98
$435.01
$477.25
$560.06
$495.25
$517.04
$455.22
$417.09
$421.12
$423.99
$443.05
$481.57
$466.62
$390.63
$415.58
$414.36
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year


% kWh per GSF Change From Previous FY
Fiscal Year
2017-18
2016-17
2015-16
2014-15
2013-14
2012-13
2011-12
2010-11
2009-10
2008-09
2007-08
2006-07
2005-06
2004-05
2003-04
2002-03
-1.05
0.16
-0.20
-0.48
-0.92
0.16
-3.93
1.83
1.30
-2.63
-0.14
-8.43
0.46
3.18
-8.23
0.57
-10.00
-9.00
-8.00
-7.00
-6.00
-5.00
-4.00
-3.00
-2.00
-1.00
0.00
1.00
2.00
3.00
4.00
% kWh/GSF change


% kWh per Student Change From Previous FY
Fiscal Year
2017-18
2016-17
2015-16
2014-15
2013-14
2012-13
2011-12
2010-11
2009-10
2008-09
2007-08
2006-07
2005-06
2004-05
2003-04
2002-03
-0.58%
1.07%
-13.18%
1.59%
8.57%
4.98%
-4.14%
2.75%
-2.38%
-5.78%
-2.80%
-7.56%
-0.46%
1.01%
3.26%
5.02%
% change in kWh consumed

The University of North Carolina at Greensboro

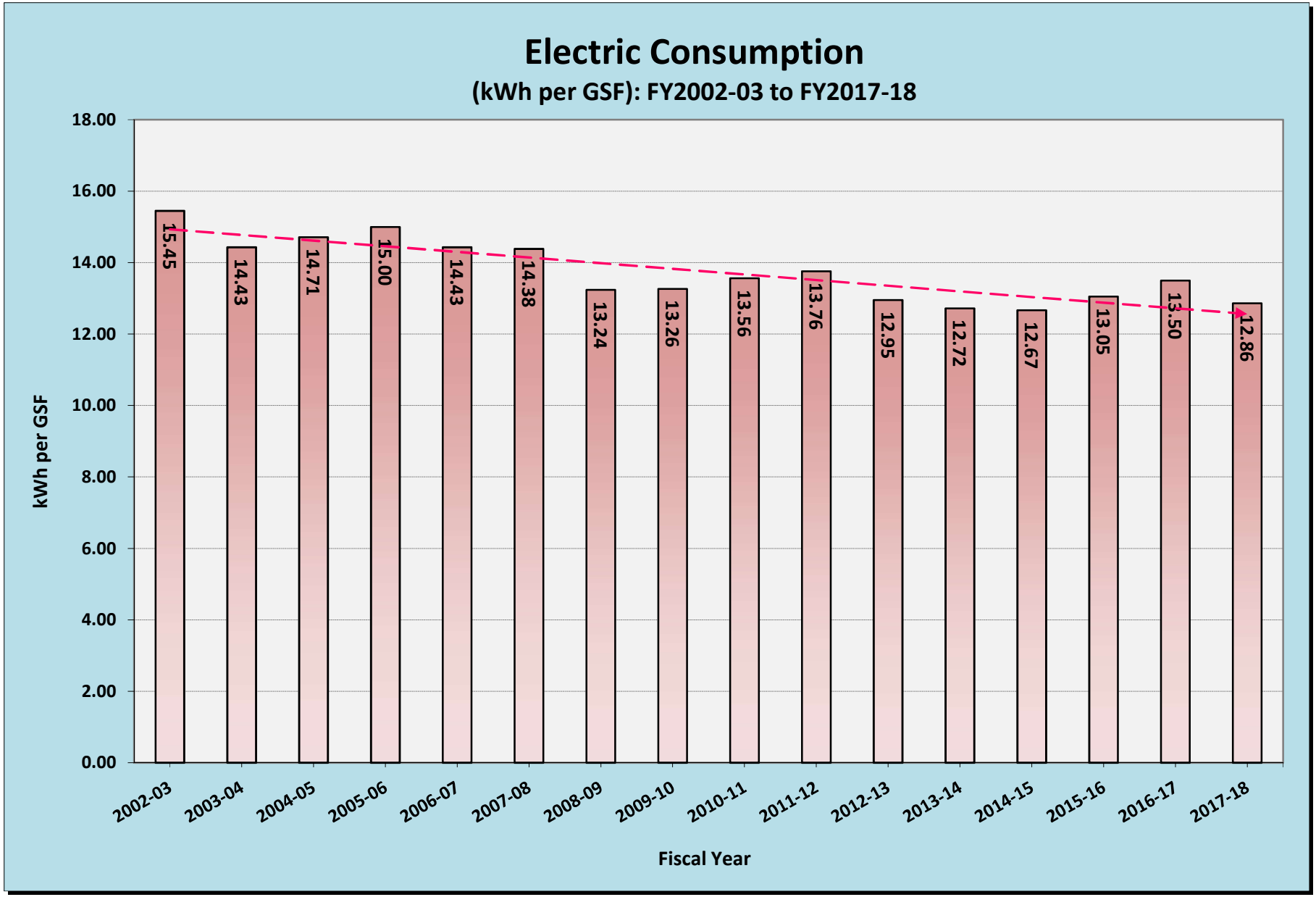
Appendix B2

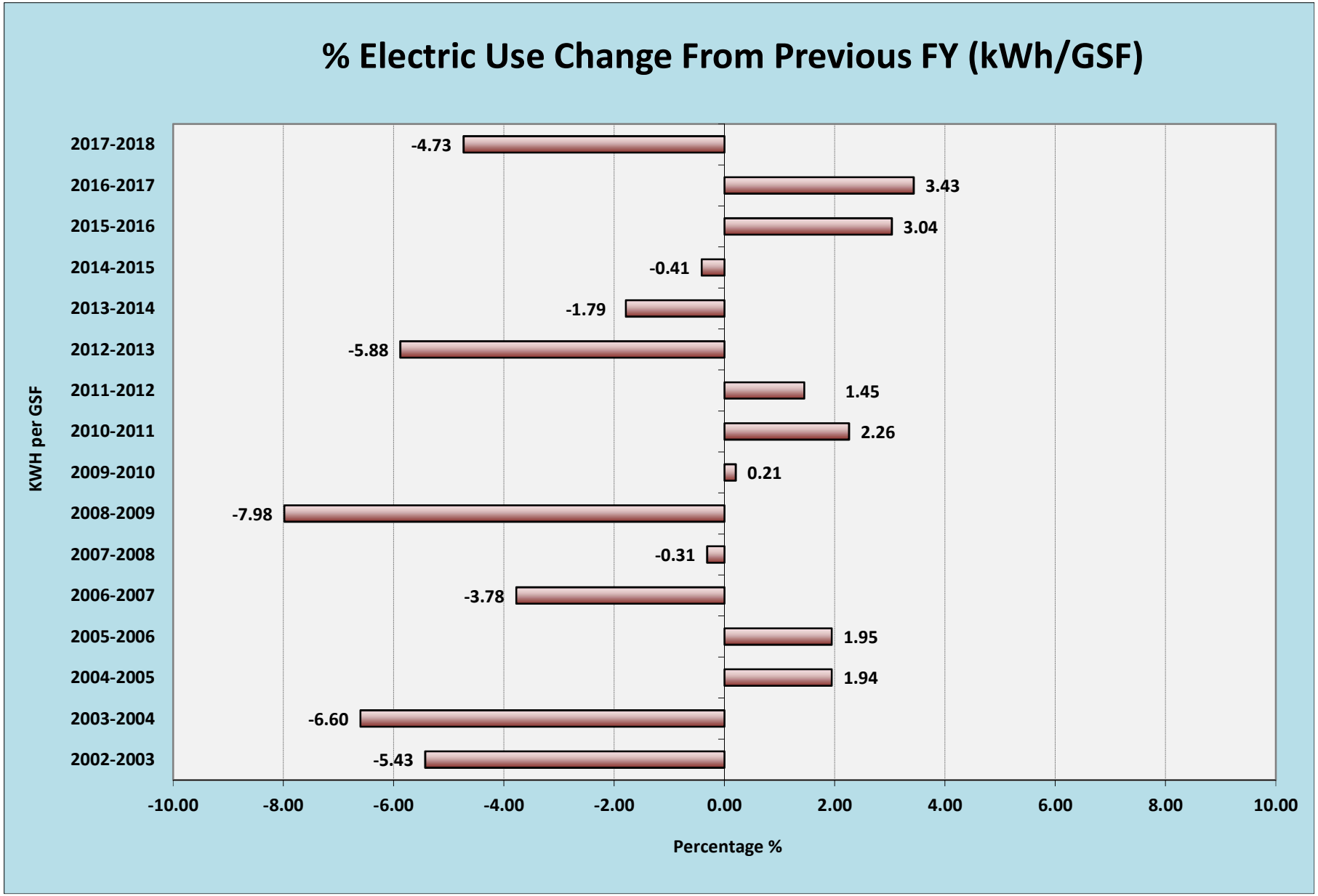
FISCAL YEAR	TOTAL ELECTRICITY (KWH)	% CHANGE	CAMPUS AREA (GSF)	STUDENT POPULATION	KWH per GSF	% CHANGE	KWH per STUDENT
1999-2000	60,092,024	-	3,785,926	11,375	15.87	-	5282.82
2000-2001	61,255,546	1.94	3,838,194	11,250	15.96	0.55	5444.94
2001-2002	63,511,420	3.68	3,888,068	11,746	16.33	2.35	5407.07
2002-2003	65,959,835	3.86	4,269,699	12,354	15.45	-5.43	5339.15
2003-2004	71,312,536	8.12	4,942,520	12,708	14.43	-6.60	5611.63
2004-2005	73,361,469	2.87	4,987,544	13,099	14.71	1.94	5600.54
2005-2006	77,641,218	5.83	5,177,689	13,723	15.00	1.95	5657.74
2006-2007	78,140,112	0.64	5,415,496	14,219	14.43	-3.78	5495.47
2007-2008	77,894,921	-0.31	5,415,496	14,704	14.38	-0.31	5297.53
2008-2009	71,678,060	-7.98	5,415,496	15,097	13.24	-7.98	4747.83
2009-2010	71,825,485	0.21	5,415,496	15,670	13.26	0.21	4583.63
2010-2011	75,289,775	4.82	5,551,245	16,036	13.56	2.26	4695.05
2011-2012	75,819,228	0.70	5,510,548	15,841	13.76	1.45	4786.27
2012-2013	74,031,758	-2.36	5,716,735	15,683	12.95	-5.88	4720.43
2013-2014	76,302,584	3.07	5,999,437	15,009	12.72	-1.79	5083.96
2014-2015	77,083,848	1.02	6,086,061	14,915	12.67	-0.41	5168.12
2015-2016	80,439,358	4.35	6,163,784	17,365	13.05	3.04	4632.20
2016-2017	86,502,867	7.54	6,408,406	17,891	13.50	3.43	4834.99
2017-2018	83,988,243	-2.91	6,531,155	18,153	12.86	-4.73	4626.69

The University of North Carolina at Greensboro

Appendix B2

FISCAL YEAR	COST	% CHANGE	COST per GSF	COST per STUDENT
	($)		($)	($)
1999-2000	2,753,822	-	0.73	242.09
2000-2001	2,843,341	3.25	0.74	252.74
2001-2002	2,922,005	2.77	0.75	248.77
2002-2003	3,018,653	3.31	0.71	244.35
2003-2004	3,306,739	9.54	0.67	260.21
2004-2005	3,482,453	5.31	0.70	265.86
2005-2006	3,669,415	5.37	0.71	267.39
2006-2007	4,209,021	14.71	0.78	296.01
2007-2008	4,349,068	3.33	0.80	295.77
2008-2009	4,109,335	-5.51	0.76	272.20
2009-2010	4,398,506	7.04	0.81	280.70
2010-2011	4,607,914	4.76	0.83	287.35
2011-2012	4,941,445	7.24	0.90	311.94
2012-2013	4,963,407	0.44	0.87	316.48
2013-2014	5,129,564	3.35	0.86	341.78
2014-2015	5,242,519	2.20	0.86	351.49
2015-2016	5,299,740	1.09	0.86	305.19
2016-2017	5,441,934	2.68	0.85	304.17
2017-2018	5,276,395	-3.04	0.81	290.66


Electric Consumption
(kWh per GSF): FY2002-03 to FY2017-18
kWh per GSF
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
15.45
14.43
14.71
15.00
14.43
14.38
13.24
13.26
13.56
13.76
12.95
12.72
12.67
13.05
13.50
12.86
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year


% Electric Use Change From Previous FY (kWh/GSF)
KWH per GSF
2017-2018
2016-2017
2015-2016
2014-2015
2013-2014
2012-2013
2011-2012
2010-2011
2009-2010
2008-2009
2007-2008
2006-2007
2005-2006
2004-2005
2003-2004
2002-2003
-4.73
3.43
3.04
-0.41
-1.79
-5.88
1.45
2.26
0.21
-7.98
-0.31
-3.78
1.95
1.94
-6.60
-5.43
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
Percentage %

The University of North Carolina at Greensboro

Appendix B3

FISCAL YEAR	TOTAL WATER (Gallons)	% CHANGE	CAMPUS AREA (GSF)	STUDENT POPULATION	GAL per GSF	% CHANGE
1999-2000	727,433,740	-	3,785,926	11,375	192.14	-
2000-2001	596,379,652	-18.02	3,838,194	11,250	155.38	-19.13
2001-2002	545,374,280	-8.55	3,888,068	11,746	140.27	-9.73
2002-2003	336,408,512	-38.32	4,269,699	12,354	78.79	-43.83
2003-2004	290,356,396	-13.69	4,942,520	12,708	58.75	-25.44
2004-2005	543,824,424	87.30	4,987,544	13,099	109.04	85.60
2005-2006	175,592,520	-67.71	5,177,689	13,723	33.91	-68.90
2006-2007	154,828,520	-11.83	5,415,496	14,219	28.59	-15.70
2007-2008	155,922,844	0.71	5,415,496	14,704	28.79	0.71
2008-2009	171,504,432	9.99	5,415,496	15,097	31.67	9.99
2009-2010	183,458,968	6.97	5,415,496	15,670	33.88	6.97
2010-2011	141,496,916	-22.87	5,551,245	16,036	25.49	-24.76
2011-2012	122,794,672	-13.22	5,510,548	15,841	22.28	-12.58
2012-2013	130,566,923	6.33	5,716,735	15,683	22.84	2.49
2013-2014	123,906,620	-5.10	5,999,437	15,009	20.65	-9.57
2014-2015	126,757,984	2.30	6,086,061	14,915	20.83	0.85
2015-2016	133,052,004	4.97	6,163,784	17,365	21.59	3.64
2016-2017	143,057,700	7.52	6,408,406	17,891	22.32	3.42
2017-2018	132,712,640	-7.23	6,531,155	18,153	20.32	-8.97

1 CCF = 748 Gallon
1 CF = 7.48 Gallon

9/4/2018

CF = Cubic Feet
CCF = 100 Cubic Feet

The University of North Carolina at Greensboro

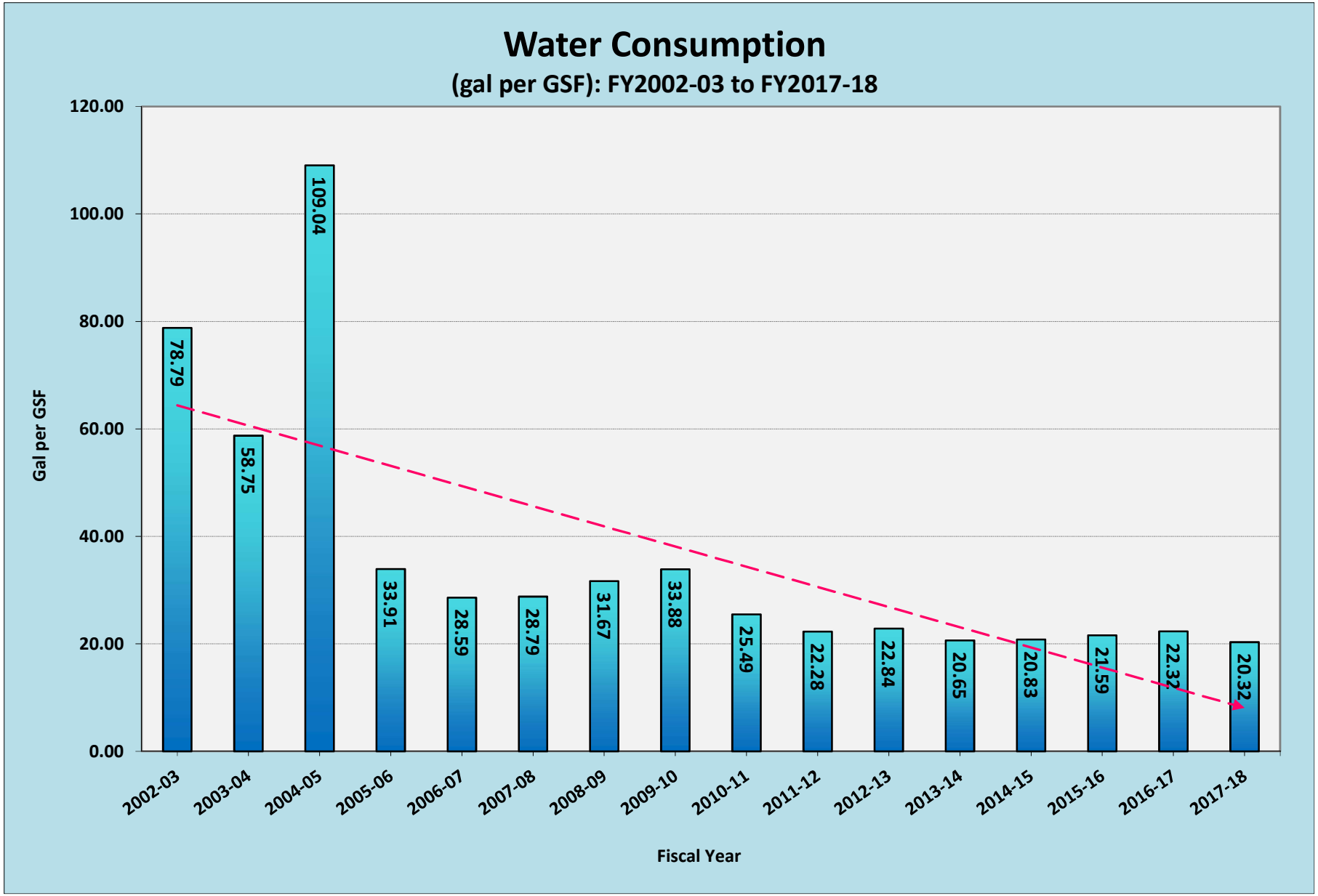
Appendix B3

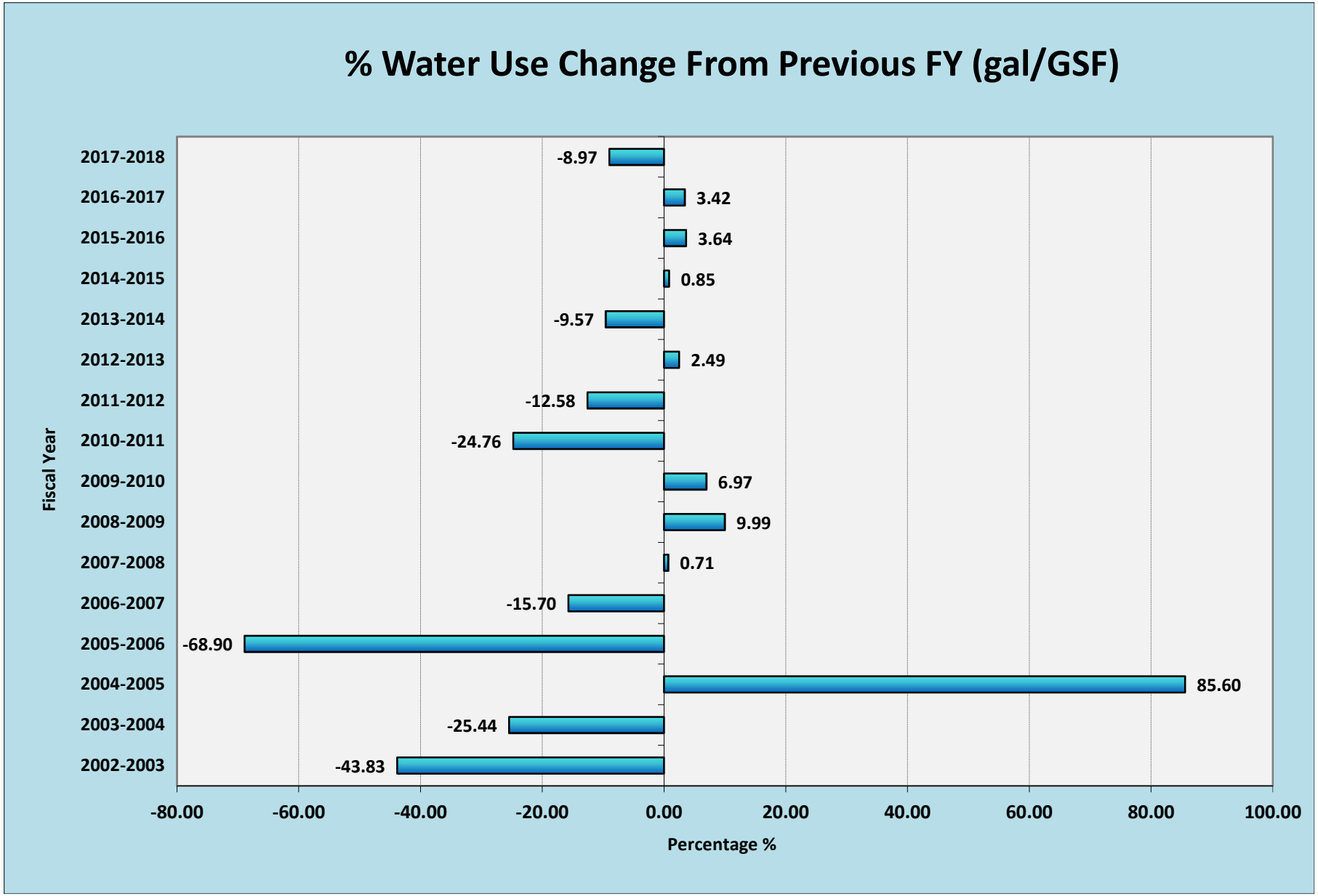
FISCAL YEAR	GAL per STUDENT	COST	% CHANGE	COST per GSF	COST per STUDENT
		($)		($)	($)
1999-2000	63,950	482,158	-	0.13	42.39
2000-2001	53,012	531,332	10.20	0.14	47.23
2001-2002	46,431	605,869	14.03	0.16	51.58
2002-2003	27,231	587,408	-3.05	0.14	47.55
2003-2004	22,848	594,070	1.13	0.12	46.75
2004-2005	41,516	659,042	10.94	0.13	50.31
2005-2006	12,795	880,466	33.60	0.17	64.16
2006-2007	10,889	895,439	1.70	0.17	62.97
2007-2008	10,604	943,305	5.35	0.17	64.15
2008-2009	11,360	1,074,919	13.95	0.20	71.20
2009-2010	11,708	1,222,175	13.70	0.23	77.99
2010-2011	8,824	940,796	-23.02	0.17	58.67
2011-2012	7,752	778,897	-17.21	0.14	49.17
2012-2013	8,325	758,603	-2.61	0.13	48.37
2013-2014	8,256	838,563	10.54	0.14	55.87
2014-2015	8,499	899,962	7.32	0.15	60.34
2015-2016	7,662	1,035,082	15.01	0.17	59.61
2016-2017	7,996	1,179,220	13.93	0.18	65.91
2017-2018	7,311	1,122,691	-4.79	0.17	61.85

1 CCF = 748 Gallon
1 CF = 7.48 Gallon

9/4/2018

CF = Cubic Feet
CCF = 100 Cubic Feet


Water Consumption
(gal per GSF): FY2002-03 to FY2017-18
Gal per GSF
120.00
100.00
80.00
60.00
40.00
20.00
0.00
78.79
58.75
109.04
33.91
28.59
28.79
31.67
33.88
25.49
22.28
22.84
20.65
20.83
21.59
22.32
20.32
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
Fiscal Year


% Water Use Change From Previous FY (gal/GSF)
Fiscal Year
2017-2018
2016-2017
2015-2016
2014-2015
2013-2014
2012-2013
2011-2012
2010-2011
2009-2010
2008-2009
2007-2008
2006-2007
2005-2006
2004-2005
2003-2004
2002-2003
-8.97
3.42
3.64
0.85
-9.57
2.49
-12.58
-24.76
6.97
9.99
0.71
-15.70
-68.90
85.60
-25.44
-43.83
-80.00
-60.00
-40.00
-20.00
0.00
20.00
40.00
60.00
80.00
100.00
Percentage %

The University of North Carolina at Greensboro

Appendix B4

FISCAL YEAR	TOTAL GAS (MMBTU)	% CHANGE	CAMPUS AREA (GSF)	STUDENT POPULATION	BTU per GSF	% CHANGE
1999-2000	265,359	-	3,785,926	11,375	70,091	-
2000-2001	223,604	-15.74	3,838,194	11,250	58,258	-16.88
2001-2002	268,172	19.93	3,888,068	11,746	68,973	18.39
2002-2003	299,499	11.68	4,269,699	12,354	70,145	1.70
2003-2004	327,836	9.46	4,942,520	12,708	66,330	-5.44
2004-2005	343,268	4.71	4,987,544	13,099	68,825	3.76
2005-2006	351,280	2.33	5,177,689	13,723	67,845	-1.42
2006-2007	327,409	-6.80	5,415,496	14,219	60,458	-10.89
2007-2008	331,499	1.25	5,415,496	14,704	61,213	1.25
2008-2009	333,251	0.53	5,415,496	15,097	61,537	0.53
2009-2010	340,272	2.11	5,415,496	15,670	62,833	2.11
2010-2011	354,134	4.07	5,581,592	16,036	63,447	0.98
2011-2012	323,982	-8.51	5,581,593	15,841	58,045	-8.51
2012-2013	352,861	8.91	5,716,735	15,683	61,724	6.34
2013-2014	368,823	4.52	5,999,437	15,009	61,476	-0.40
2014-2015	366,547	-0.62	6,086,061	14,915	60,227	-2.03
2015-2016	361,645	-1.34	6,163,784	17,365	58,672	-2.58
2016-2017	373,496	3.28	6,408,406	17,891	58,282	-0.67
2017-2018	368,273	-1.40	6,531,155	18,153	56,387	-3.25

1 Therm = 10 mmBTU
1 Therm = 29.3 KWH

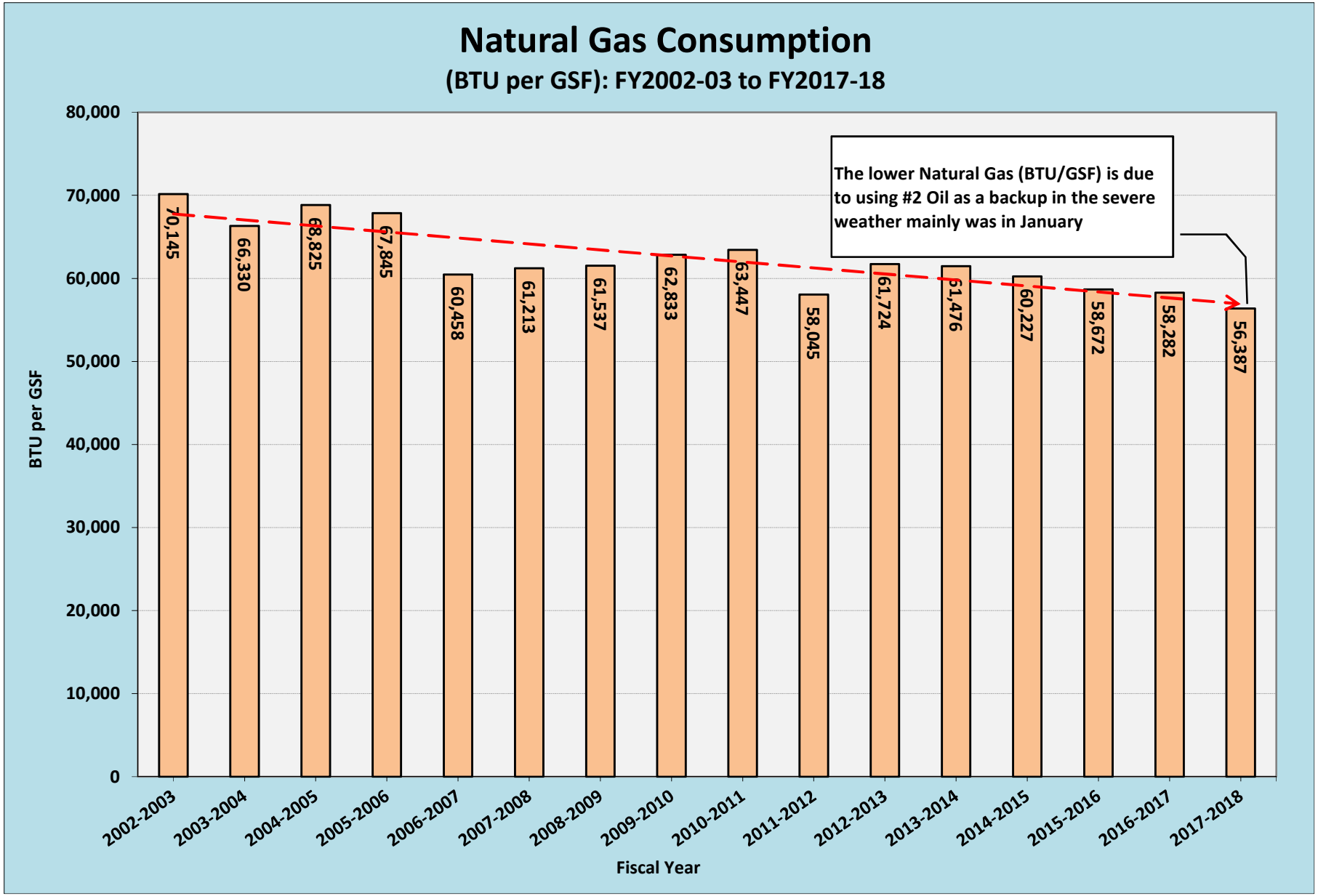
9/4/2018

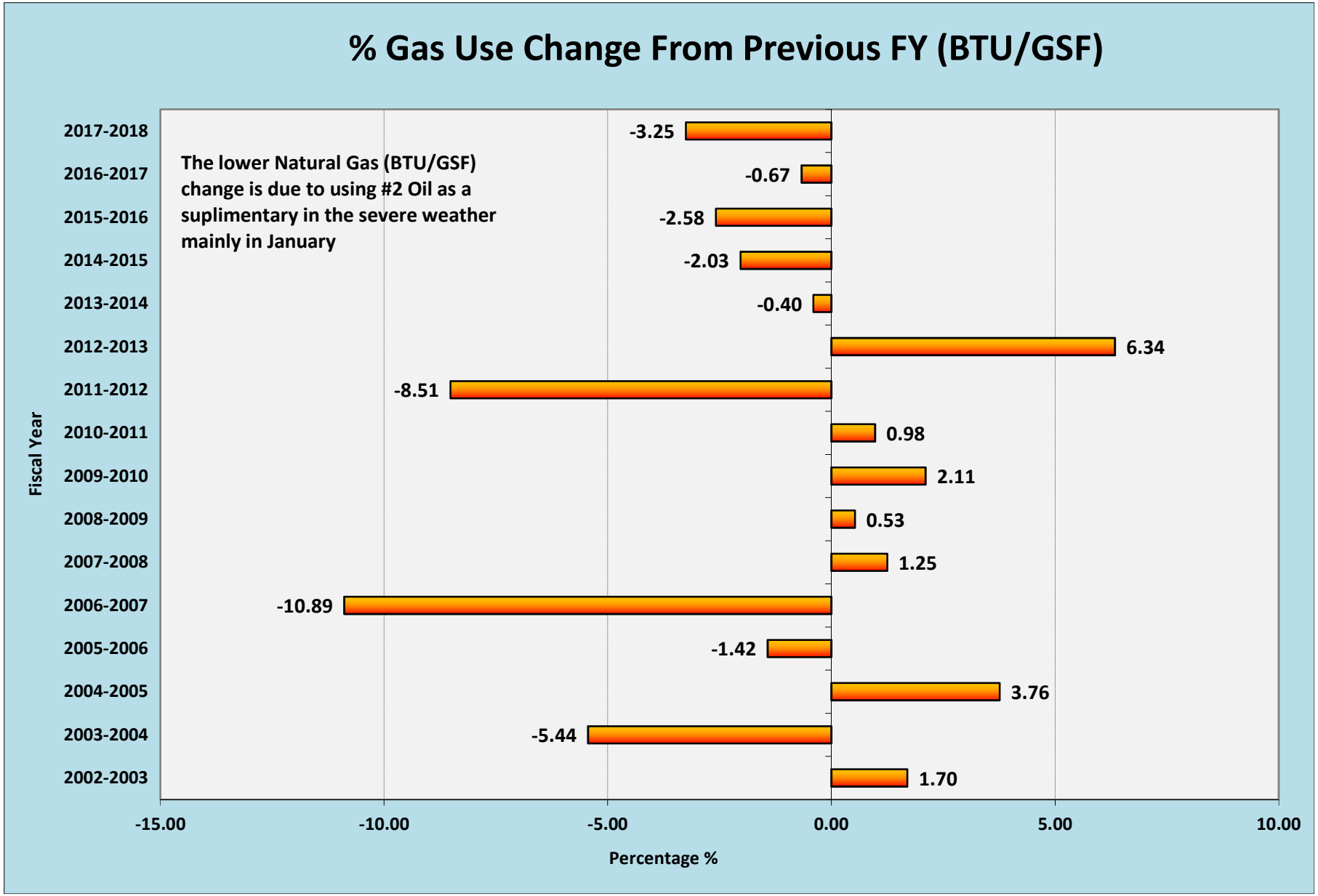
The University of North Carolina at Greensboro

Appendix B4

FISCAL YEAR	COST ($)	% CHANGE	MMBTU per STUDENT	COST per GSF ($)	COST per STUDENT ($)
1999-2000	1,161,590	-	23.33	0.31	102.12
2000-2001	1,576,937	35.76	19.88	0.41	140.17
2001-2002	3,171,851	101.14	22.83	0.82	270.04
2002-2003	1,870,689	-41.02	24.24	0.44	151.42
2003-2004	2,219,449	18.64	25.80	0.45	174.65
2004-2005	2,756,240	24.19	26.21	0.55	210.42
2005-2006	3,901,745	41.56	25.60	0.75	284.32
2006-2007	2,828,934	-27.50	23.03	0.52	198.95
2007-2008	3,244,681	14.70	22.54	0.60	220.67
2008-2009	2,751,995	-15.18	22.07	0.51	182.29
2009-2010	2,129,166	-22.63	21.71	0.39	135.88
2010-2011	2,064,099	-3.06	22.08	0.37	128.72
2011-2012	1,714,907	-16.92	20.45	0.31	108.26
2012-2013	1,880,320	9.65	22.50	0.33	119.89
2013-2014	2,097,211	11.53	24.57	0.35	139.73
2014-2015	1,627,646	-22.39	24.58	0.27	109.13
2015-2016	1,432,119	-12.01	20.83	0.23	82.47
2016-2017	1,990,633	39.00	20.88	0.31	111.26
2017-2018	1,936,820	-2.70	20.29	0.30	106.69

1 Therm = 10 mmBTU
1 Therm = 29.3 KWH


Natural Gas Consumption
(BTU per GSF): FY2002-03 to FY2017-18
The lower Natural Gas (BTU/GSF) is due to using #2 Oil as a backup in the severe weather mainly was in January
BTU per GSF
Fiscal Year
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
70,145
66,330
68,825
67,845
60,458
61,213
61,537
62,833
63,447
58,045
61,724
61,476
60,227
58,672
58,282
56,387
2002-2003
2003-2004
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
2017-2018


% Gas Use Change From Previous FY (BTU/GSF)
The lower Natural Gas (BTU/GSF) change is due to using #2 Oil as a suplimentary in the severe weather mainly in January
Fiscal Year
2017-2018
2016-2017
2015-2016
2014-2015
2013-2014
2012-2013
2011-2012
2010-2011
2009-2010
2008-2009
2007-2008
2006-2007
2005-2006
2004-2005
2003-2004
2002-2003
-3.25
-0.67
-2.58
-2.03
-0.40
6.34
-8.51
0.98
2.11
0.53
1.25
-10.89
-1.42
3.76
-5.44
1.70
-15.00
-10.00
-5.00
0.00
5.00
10.00
Percentage %

Appendix C
Annual Energy Comparison Data

id	year	name	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $	2oil gals	2oil $	6 oil gals	6oil $	propane gals	propane $	coal tons	coal $	wood tons	wood $	steam klbs	steam $	chw tons	chw $	kgal water	water sewer $	gsf	construction gsf	renovated A/C gsf	stm_eff_factor	chw_eff_factor	cogen_adj
60005004	2002-03	UNC Greensboro	$5,537,461	$4,990,987	537,824,232,290	65,959,835	$3,018,653	2,994,990	$1,870,689	95,683	$101,645	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	336,409	$546,474	4,269,699	0	0	1	1	0
60005004	2003-04	UNC Greensboro	$6,085,348	$5,527,654	571,384,004,782	71,312,536	$3,306,739	3,278,361	$2,219,449	1,655	$1,466	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	290,356	$557,694	4,942,520	0	0	1	1	0
60005004	2004-05	UNC Greensboro	$6,878,519	$6,248,603	594,916,006,798	73,361,469	$3,482,455	3,432,679	$2,756,241	9,653	$9,907	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	543,823	$629,916	4,987,544	0	46,245	1	1	0
60005004	2005-06	UNC Greensboro	$8,455,503	$7,622,474	620,424,399,856	77,641,218	$3,669,416	3,512,803	$3,901,745	30,516	$51,313	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	175,592	$833,029	5,177,689	95,350	273,666	1	1	0
60005004	2006-07	UNC Greensboro	$7,674,070	$6,884,414	602,349,019,764	78,140,112	$4,209,021	3,355,272	$2,674,278	1,498	$1,115	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	144,127	$789,656	5,415,496	0	266,527	1	1	0
60005004	2007-08	UNC Greensboro	$8,500,093	$7,593,983	597,302,044,172	77,894,921	$4,349,067	3,314,985	$3,244,678	188	$238	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	155,923	$906,110	5,415,496	0	139,845	1	1	0
60005004	2008-09	UNC Greensboro	$7,906,663	$6,861,603	577,867,007,810	71,678,060	$4,109,335	3,332,514	$2,751,994	361	$274	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	171,504	$1,045,060	5,415,496	0	49,459	1	1	0
60005004	2009-10	UNC Greensboro	$7,713,099	$6,530,241	585,475,000,190	71,825,485	$4,398,506	3,402,715	$2,129,166	973	$2,569	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	183,459	$1,182,858	5,415,496	0	0	1	1	0
60005004	2010-11	UNC Greensboro	$7,653,606	$6,753,156	615,586,800,200	75,289,775	$4,607,914	3,541,338	$2,064,099	32,910	$81,143	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	141,497	$900,450	5,551,245	205,419	0	1	1	0
60005004	2011-12	UNC Greensboro	$7,402,485	$6,663,983	582,985,313,806	75,819,228	$4,941,445	3,239,818	$1,714,907	2,223	$7,631	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	122,795	$738,502	5,510,548		206,187	1	1	0
60005004	2012-13	UNC Greensboro	$7,571,726	$6,853,774	605,897,299,046	74,031,758	$4,963,407	3,528,606	$1,880,320	3,175	$10,047	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	130,567	$717,952	5,716,735	0	421,972	1	1	0
60005004	2013-14	UNC Greensboro	$8,034,092	$7,234,731	629,295,359,870	76,232,065	$5,129,564	3,688,225	$2,097,211	2,661	$7,956	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	123,907	$799,361	5,999,437	122,071	0	1	1	0
60005004	2014-15	UNC Greensboro	$7,859,390	$6,959,803	635,533,843,220	77,083,848	$5,242,519	3,665,469	$1,627,646	43,095	$89,638	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	126,758	899,587	6,086,061	28,307	67,677	1	1	0
60005004	2015-16	UNC Greensboro	$7,776,021	$6,783,434	642,375,765,026	80,439,358	$5,299,740	3,616,446	$1,432,119	45,224	$51,574	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	133,052	992,588	6,163,784	0	76,440	1	1	0
60005004	2016-17	UNC Greensboro	$8,569,900	$7,435,123	668,955,111,870	86,502,867	$5,441,934	3,734,964	$1,990,633	2,242	$2,556	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	143,058	1,134,777	6,408,406	190,025	63,053	1	1	0
60005004	2017-18	UNC Greensboro	$8,621,691	$7,521,794	674,605,778,318	83,988,243	$5,276,395	3,682,733	$1,936,820	142,509	$308,578	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	132,713	$1,099,897	6,531,155	191,211	121,552	1	1	0
60005004	2018-19	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2019-20	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2020-21	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2021-22	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2022-23	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2023-24	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0
60005004	2024-25	UNC Greensboro	$0	$0	0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	0	0	1	1	0

			energy evaluation						water/sewer evaluation				
			energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
60005004	2002-03	UNC Greensboro		$1.17	$9.28		125,963			$1.62		78.79	
60005004	2003-04	UNC Greensboro	$495,227	$1.12	$9.67	4%	115,606	-8.22%	$190,276	$1.92	18%	58.75	-25%
60005004	2004-05	UNC Greensboro	$350,078	$1.25	$10.50	13%	119,280	-5.31%	-$174,737	$1.16	-29%	109.04	38%
60005004	2005-06	UNC Greensboro	$390,360	$1.47	$12.29	32%	119,827	-4.87%	$1,102,331	$4.74	192%	33.91	-57%
60005004	2006-07	UNC Greensboro	$912,094	$1.27	$11.43	23%	111,227	-11.70%	$1,548,111	$5.48	237%	26.61	-66%
60005004	2007-08	UNC Greensboro	$1,078,770	$1.40	$12.71	37%	110,295	-12.44%	$1,573,477	$5.81	258%	28.79	-63%
60005004	2008-09	UNC Greensboro	$1,238,285	$1.27	$11.87	28%	106,706	-15.29%	$1,554,953	$6.09	275%	31.67	-60%
60005004	2009-10	UNC Greensboro	$1,078,314	$1.21	$11.15	20%	108,111	-14.17%	$1,568,215	$6.45	297%	33.88	-57%
60005004	2010-11	UNC Greensboro	$917,826	$1.22	$10.97	18%	110,892	-11.96%	$1,882,934	$6.36	292%	25.49	-68%
60005004	2011-12	UNC Greensboro	$1,270,418	$1.21	$11.43	23%	105,794	-16.01%	$1,872,674	$6.01	270%	22.28	-72%
60005004	2012-13	UNC Greensboro	$1,291,804	$1.20	$11.31	22%	105,987	-15.86%	$1,758,788	$5.50	239%	22.84	-71%
60005004	2013-14	UNC Greensboro	$1,453,302	$1.21	$11.50	24%	104,892	-16.73%	$2,250,133	$6.45	297%	20.65	-74%
60005004	2014-15	UNC Greensboro	$1,435,525	$1.14	$10.95	18%	104,425	-17.10%	$2,503,502	$7.10	337%	20.83	-74%
60005004	2015-16	UNC Greensboro	$1,415,379	$1.10	$10.56	14%	104,218	-17%	$2,630,387	$7.46	359%	21.59	-73%
60005004	2016-17	UNC Greensboro	$1,536,774	$1.16	$11.11	20%	104,387	-17%	$2,870,382	$7.93	388%	22.32	-72%
60005004	2017-18	UNC Greensboro	$1,651,060	$1.15	$11.15	20%	103,290	-18%	$3,164,917	$8.29	410%	20.32	-74%
60005004	2018-19	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2019-20	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2020-21	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2021-22	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2022-23	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2023-24	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
60005004	2024-25	UNC Greensboro	$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%

			$/kwh	$/therm	2 oil $/gal	6 oil $/gal	propane$/gal	coal $/ton	wood $/ton	steam $/mlb	chw $/ton
60005004	2002-03	UNC Greensboro	$0.0458	$0.625	$1.06	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2003-04	UNC Greensboro	$0.0464	$0.677	$0.89	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2004-05	UNC Greensboro	$0.0475	$0.803	$1.03	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2005-06	UNC Greensboro	$0.0473	$1.111	$1.68	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2006-07	UNC Greensboro	$0.0539	$0.797	$0.74	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2007-08	UNC Greensboro	$0.0558	$0.979	$1.26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2008-09	UNC Greensboro	$0.0573	$0.826	$0.76	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2009-10	UNC Greensboro	$0.0612	$0.626	$2.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2010-11	UNC Greensboro	$0.0612	$0.583	$2.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2011-12	UNC Greensboro	$0.0652	$0.529	$3.43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2012-13	UNC Greensboro	$0.0670	$0.533	$3.16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2013-14	UNC Greensboro	$0.0673	$0.569	$2.99	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2014-15	UNC Greensboro	$0.0680	$0.444	$2.08	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2015-16	UNC Greensboro	$0.0659	$0.396	$1.14	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2016-17	UNC Greensboro	$0.0629	$0.533	$1.14	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2017-18	UNC Greensboro	$0.0628	$0.526	$2.17	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2018-19	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2019-20	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2020-21	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2021-22	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2022-23	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2023-24	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2024-25	UNC Greensboro	$0.0000	$0.000	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Cost per Therm (100,000 Btu) all Energy Sources

60005004	2002-03	UNC Greensboro	$1.34	$0.62	$0.76	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2003-04	UNC Greensboro	$1.36	$0.68	$0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2004-05	UNC Greensboro	$1.39	$0.80	$0.73	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2005-06	UNC Greensboro	$1.39	$1.11	$1.20	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2006-07	UNC Greensboro	$1.58	$0.80	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2007-08	UNC Greensboro	$1.64	$0.98	$0.90	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2008-09	UNC Greensboro	$1.68	$0.83	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2009-10	UNC Greensboro	$1.79	$0.63	$1.89	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2010-11	UNC Greensboro	$1.79	$0.58	$1.76	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2011-12	UNC Greensboro	$1.91	$0.53	$2.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2012-13	UNC Greensboro	$1.96	$0.53	$2.26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2013-14	UNC Greensboro	$1.97	$0.57	$2.14	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2014-15	UNC Greensboro	$1.99	$0.44	$1.49	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2015-16	UNC Greensboro	$1.93	$0.40	$0.81	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2016-17	UNC Greensboro	$1.84	$0.53	$0.81	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2017-18	UNC Greensboro	$1.84	$0.53	$1.55	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2018-19	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2019-20	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2020-21	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2021-22	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2022-23	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2023-24	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005004	2024-25	UNC Greensboro	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Appendix D
Strategic Energy Plan Activities Matrix

STRATEGIC ENERGY PLAN:

1. Energy Data Management

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Updated the utility data and charts posted on UNCG energy website.	Annual		8 man-hours	
Updated the Key Performance Indicators (KPI) data for the APPA annual report.	Annual		8 man-hours	
Connected to the BAS ten (10) electric Shark submeter for the retail stores at the new constructed buildings McCormick Residence Hall and Lexington Residence Hall.	Monthly AND Annual		8 man-hours	
Campus-Wide Control Conversions plan is expanded to include (3) buildings on campus. Building Controls upgrades to Tridium from Signal at Sullivan Science Building, 1100 West Market Building and Chemical Safety Building.	Monthly electrical consumption	$11,513	$118,050	Utility Savings Carry Forward funds
Continued the plan of installing utility meters to all buildings on campus and connecting them as possible to the BAS.			$18,830	Utility Savings Carry Forward funds
For each of Mossman Building and Brown Building, UNCG installed a TVA steam meter and connected it to the BAS; the two meters are included in the monthly reading process for a database integrity and energy analysis.		-	$20,315	Utility Savings Carry Forward funds
Continue evaluating energy usage in buildings on campus and comparing results over each other to determine savings.	Monthly and Annual		40 man-hours	
Future Planned Activities	**Measurement**	**Savings Estimated**	**Cost**	**Funding Source**
Campus-Wide Building Control Conversion plan, converting the Building Automation System (BAS) to Tridium Niagra AX from Signal Global Control Module (GCM) at Coleman, Eberhart, Becher-Weaver, POCAM Offices at Walker Deck, Sink Building, Ferguson Building and Foust Building.	Annual	$3,640	$200,000	Utility Savings Carry Forward and R&R funds
Install as fund available utility meters for each building on campus and connect them to the Building Automation System (BAS) to track energy usage.				TBD
Assess Building's energy consumption using meter information for trends and data-driven decision making (Vykon replacement). Energy assessment will be implemented once every building is "fully metered" and all meters are integrated.			TBD	O&M funds
Install and integrate to the Tridium Building Automation System (2) TVA steam meter, at Stone Building and Petty Building.			$26,000	Utility Savings Carry Forward
Continue to incorporate buildings into the Tridium Building Automation System, which will allow for better energy analysis and better control of energy usage.	Annual			TBD
Update utility data and charts posted on UNCG website for energy usage.	Annual		8 man-hours	O&M funds

STRATEGIC ENERGY PLAN:
2. Energy Supply Management

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Campus Mechanical Engineer worked with Duke Energy on a rate analysis for University electricity accounts.	Annual		8-man-hours	
Energy Analyst continued to waive taxes from the new added UNCG's Piedmont Natural Gas accounts; that resulted a tax exemption for 326 and 328 Tate St, 812 Lilly Ave, 15 ClubView, and Spartan Village II accounts.	Annual		8-man-hours	
Continue purchased natural gas for the Steam Plant via State Term Contract 405N in order minimize expenditures.	Annual		8-16 man-hours	Utility Budget
Energy Analyst compared the differences in cost of what have been purchased of #2 Fuel Oil versus what would've been if Natural Gas used instead through the winter storm curtailment periods.			8-16 man-hours	
Initiated utility accounts water, electric and natural gas for two (2) new constructed buildings McCormick and Lexington Residence Hall. Also started new utility accounts for other buildings added to UNCG 15 ClubVIew, 812 Lilly Ave, 328 and 326 Tate St.	Monthly		8-man-hours	
Future Planned Activities	**Measurement**	**Savings Estimated**	**Cost**	**Funding Source**
Conduct a feasibility study for potential of (80 kW) ground mounted or roof top solar photovoltaic (PV) installations at new or existing University facilities.				TBD
Campus Mechanical Engineer continue the work with Duke Energy on a rate analysis for University electricity accounts, including the new constructed McCormick and Lexington Residence Hall at Spartan Village II.	Annual			

STRATEGIC ENERGY PLAN:
3. Energy Use in Facilities

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Expanded the "Standards of Comfort" policy (set points for occupied/unoccupied modes and occupancy hours) to include new added buildings 812 Lilly Ave, 326 and 328 Tate Street.	Monthly	>$1,093,012 since inception in 2012	1 man hour per building. $15 per thermostat cover.	O&M funds
Continue on with the ninth year of the Guaranteed Energy Saving Contract (Performance Contract), with an actual more than estimated savings at the main McIver Chiller Plant and four buildings, Mossman Building, Bryan Building, Graham Building and Jackson Library building.	Annual	$847,308 ($798,123 guaranteed, $49,185 excess)	Avoided $6.1 million, approx. $500,000/year for 12 years	Utility Budget (Performance Contract)
Continue evaluating the energy performance of the Leonard J. Kaplan Center for Wellness, by comparing over each other two years of operation in terms of Energy Use Intensity EUI and utility budget.	Monthly, quarterly, and annually	$71,721 in utility cost compared to first year of operations	40 man-hours	
Finished upgrading eleven (11) existing site lighting fixtures in Foust Park from high pressure sodium to LED.	Monthly electrical consumption	$194	$4,023	Green Fund
Started the construction work of Nursing & Instructional Building and South Chiller Plant part of the Connect NC Bond. The new stand-alone chiller plant with an initial build out of 1,500 cooling tons with future expansion capabilities to an ultimate capacity of 7,500 tons. the new South Chiller Plant will be integrated with the currently existing McIver Chiller Plant to carry the Campus cooling load.			$105,000,000	Capital Projects
Performed a building envelope studies and repairs for three buildings on campus Bryan Building, Weatherspoon Art Museum, and Mossman Building, and also included EUC water intrusion study.	Annual		$93,800	R&R fund
Finish a mechanical equipment upgrade and also roof replacement at Tower Village Residence Hall			$93,800	
Finish the construction of two new residence halls McCormick and Lexington at Spartan Village Student Housing Phase II with retail spaces run by vendors to serve the student. The retail spaces have a separate energy meters to pay utility by the vendors and to eliminate these spaces from UNCG energy foot print.			$37,000,000	Capital Facilities Foundation
Track the Energy Use Intensity EUI and compare them over existing similar halls at the new constructed McCormick and Lexington residence Hall at Spartan Village II.	Monthly and Annual			
Finished the construction work of renovating Cone Residence Hall by the begin of Fall 2018.			$10,971,000	
Finished site lighting LED conversion at the McIver Pedestrian Mall and Peabody Park.	Annual			O&M funds

Future Planned Activities	Measurement	Savings Estimated	Cost	Funding Source
Implement the second ESCO project.	Annual	TBD	TBD	Utility Budget (Performance Contract)
Continue monitoring first Performance Contract stipulations for McIver Chiller Plant and four campus buildings.	Annual	Approx. $500,000/year for 12 years plus $15,000-$25,000 in excess savings		Utility Budget (Performance Contract)
Focus on using the Ultra-Probe ultrasound detecting device for monitoring and maintenance program that detects for the compressed air leak.				O&M funds
Continue the process of upgrading Building Automation Systems (BAS) in conjunction with renovation projects as possible.				R&R funds, Capital Project funding
Continue with the third year of operation evaluating and monitoring the energy performance of the Leonard J. Kaplan Center for Wellness by verifying actual performance over the design first and previous years performance second.	Monthly energy and water consumption			
Plan to communicate with the Sustainability Office and the Registrar Office to implement Buildings Consolidation approach for scheduling summer classes in buildings that constantly run through summer. Determine with Registrar the most appropriate buildings to use for classes in summer.				O&M funds
Continue to seek low-cost and no-cost ways to improve the utility operations system.	Annual	TBD		O&M funds
Replace the existing fire alarm system in Curry Building.			$425,000	
Upgrade the existing fire alarm system in Philip Hawkins Residence Hall.			$990,000	
Replace the obsolete HVAC control for campus wide that would continue for 4 years.	Annual		$100,000	R&R fund
Continue construction of the Nursing & Instructional Building and complete construction of the new South Chiller Plant.			$105,000,000	Capital Projects
Continue upgrade to LED the exterior site lighting to include areas around Peabody Park, and McIver Pedestrian Mall				O&M funds
Finish upgrading the electrical system in the Foust Building by replacing branch circuit wiring and (4) Federal Pacific distribution panels.	Annual		$500,000	R&R fund
Conduct a Facility Condition Assessment study on twenty-three of the HR&L buildings; (1) Ragsdale Mendenhall; (2) Weil Winfield; (3) Moore Strong; (4) Phillip Hawkins; (5) Mary Foust; (6) Guilford; (7) North Spencer; (8) South Spencer; (9) Reynolds; (10) Grogan; (11) Cone; (12) Tower Village; (13~19) Quad (all 7 bldgs.); (20) Spring Garden Apartments; (21) Jefferson Suites; (22) Lofts on Lee; and, (23) Spartan Village I.				
Design a new fire alarm system to replace the existing with fully- addressable system for Coleman Building.			$22,000	O&M funds
Finish the design of a new fire alarm system to replace the existing one at Weil Winfield Residence Hall as the scope of work expanded by the customer.				

STRATEGIC ENERGY PLAN:

4. Equipment Efficiency

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Implemented a Campus Chilled Water System Building Commissioning calibrating and checking the operation of individual buildings chilled water system.		$3,844	$3,275	Utility Savings Carry Forward funds
Install a CO2 Demand Control Ventilation (DCV) at (6) Air handlers in the Elliott University Center to minimize the outdoor intake ventilation to the minimum demanded level.	Annual	$3,977	$13,232	Utility Savings Carry Forward funds
Implemented for McIver Chiller Plant system a controls upgrade and incorporated a new variable primary chilled water and condenser water pumping strategy, including loop pump control.	Annual	$5,929	$46,789	Utility Savings Carry Forward funds
Continue converting to LED lights through in-house projects for spaces in Sullivan Science, Steam Plant, Music Building, Coleman Building, Mossman Building, Stone Building, Eberhart Building, Jackson Library, and Faculty Center.	Annual	$7,794	$149,525	Utility Savings Carry Forward funds
Installed two (2) Variable Frequency Drives (VFD), each for a Hot Water System at Coleman Building and the Elliot University Center. The work included replacing pump motors with more efficient VFD-rated motors, and adding a differential pressure transmitter for controlling the pump/motor speed.	Annual	$9,265	$51,675	Utility Savings Carry Forward funds
Replace (3) live front medium voltage switch on campus-wide to prevent potential power failure.	Annual		$150,000	R&R funds
Design campus wide exterior lighting upgrade to LED with multiple phases.			$10,000	O&M funds
Finish the design and bid for Phase IV underground steam and condensate piping replacement to eliminate multiple failures between the Elliott University Center and the Bryan Building.	Annual		$200,000	R&R funds
Finish the construction work of roof replacement at Jackson Library main 1951 wing and tower connector			$1,276,024	R&R funds
Replace emergency generator at the Elliot University Center			$25,000	R&R funds
Continue monitoring the controls and performance of the fume hood exhaust fans of the supply air at the six (6) chemistry teaching labs at the Sullivan Science Building.	Monthly electrical consumption	~ 105,000		
Inspection and rebuild of Chiller #3 at McIver Chiller Plant				R&R funds

Future Planned Activities	Measurement	Savings Estimated	Cost	Funding Source
Steam Distribution system replacement Phase IV.	Annual		$600,000	R&R funds
Replace live-front pad mount transformer that are degrading at Mossman Building.			$70,000	R&R funds
Conduct efforts to tune-ups boilers on an annual basis.	Annual			TBD
Continue the efforts to upgrade to a high-efficiency motors the failed ones and connect them as the fund available to BAS.				O&M funds
Install occupancy sensors for the classrooms at the Stone Building.	Monthly electrical consumption	$7,800	$15,000	O&M funds
Install VFDs where applicable to achieve energy savings.				TBD
Continue the efforts to tune-up the mechanical electrical and HVAC systems, and pools' water consumption at the Kaplan Center for Wellness.	Monthly energy consumption			R&R funds
Replace Graham Building's roof that exists since 1997.			$350,000	R&R funds
Replace generator Automatic Transfer Switch (ATS) at the Bryan Building (Business and Economic School).			$31,947	R&R funds
Perform campus wide converting Buildings Control to Tridium from Signal, at seven (7) buildings Coleman, Eberhart, Becher-Weaver, POCAM Offices at Walker Deck, Ferguson, Foust and Sink Building	Monthly energy consumption		$200,000	R&R and Utility Savings Carry Forward funds
Carry on a campus-wide medium-voltage replacement plan of the live front electrical switches in campus wide electrical distribution system.				R&R funds
Renovate the lighting system for (7) art galleries at the Weatherspoon Art Museum Building due to deterioration and damage in the infrastructure of the system.			$246,500	R&R funds

STRATEGIC ENERGY PLAN:
5. Organization Integration

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Submitted 1292 report to the Utility Savings Initiatives (USI) to claim and carry forward to the next year the appropriate energy savings credits.	Annual		Approx. 40 man-hours	
Reported to the State Construction Office SB 668 utility data of fourteen (14) buildings on campus.	Annual		Approx. 60 man-hours	O&M funds
Updated the Strategic Energy Plan and submitted to the State Energy Office.				
Sent multiple representatives from Facilities and the Sustainability Office to the Appalachian Energy Summit in summer July 2017 and mid-year meeting at Wake Forest in February 2018.	Annual		Travel	Department budget
The Sustainability Office has supported Climate Action Plan workgroup on energy in reformulating, identifying work plan, and following up on implementing actions.				
Facilities Operations sent two representatives to attending the annual State Energy Conference in Raleigh, April 17-18, 2018.			Travel	Department budget
Future Planned Activities	**Measurement**	**Savings Estimated**	**Cost**	**Funding Source**
Host Appalachian Energy Summit 2019 Mid-Year meeting is planned to be held at UNCG.				
University Energy Analyst registered to attend the Energy Management Diploma program at NCSU that is supported by the USI initiatives.				
Certify additional groups under the voluntary Green Office 3.0 Certification Program and expand the participation to spread awareness of and incentivize energy conservation and other sustainability issues and practices.	Annual - Number of Offices with New or Renewed Certifications	Varies	8 staff hours per month	General Funds
Certify campus residents under the new voluntary Green Room Certification Program; Also create and deploy new ‘green room recommended program” with bookstore, including items that are high performing in the energy use realm.				
Continue efforts to developing new "behavioral" based energy conservation programs, including a building energy stewards program.	Monthly			O&M funds
Continue supporting the Climate Action Plan workgroup on energy in identifying work plan for year and implementing actions to support the implementation and fulfill our Climate Commitment to the American College and University Presidents'.	Quarterly			
Attend the State Energy Conference, Midyear Energy Summit and Appalachian Energy Summit.	Annual		Travel	
Continue supporting the UNCG Green Fund student support program managed by the Sustainability Office to encourage applications with energy savings approach.	Annual			
Report to the State Construction Office the SB 668 utility data; and continue updating the Strategic Energy Plan.	Annual			O&M funds

STRATEGIC ENERGY PLAN:
6. Water Management

Past Year Accomplishments	Measurement	Savings Actual or Calculated	Cost	Funding Source
Continue on a monthly basis reading the metered irrigation and cooling towers, and report data to receiving the non-sewered water credits from the Water Resources Department of the City of Greensboro.	The Plumbing Shop are monthly reporting the City for Non-Sewer Water Credits	$239,277 credit for 50,037,280 Gallons of non-sewered water	8 man-hours per month	O&M funds
Continue waterless mopping system on campus.	Gallons of water saved			O&M funds
Investigate and repair any leaks in the water and steam condensate line on campus.				O&M funds
Finish the construction work of upgrading the lap pool at the Leonard J. Kaplan Center for Wellness approved by the County Health Department.				
Replacing (10) main isolation valves at the sectionalizing and building level that are no longer functional.	Annual		$82,543	R&R
Future Planned Activities	**Measurement**	**Savings Estimated**	**Cost**	**Funding Source**
Continue gathering meter readings from irrigation and cooling towers in order to receive the non-sewered water credits from the City of Greensboro.	Report submeter readings to the City on a monthly basis	Approx. $200,000-$250,000	8 man-hours per month	O&M funds
Apply as possible the actions and recommendations of the Water Resources Team from the Climate Action Plan.				
Renovate, replace, or repair with low-flow devices and building water meters for new buildings and buildings undergoing renovation as funds available.				Capital Projects
Integrate to the building automation system water meters on campus as fund available.				O&M funds
Continue and expand to include new areas be controlled by Sentinel irrigation on campus.				
Continue investigating and repairing any water and steam condensate leaks in campus loops.				O&M funds, R&R

The University of North Carolina Greensboro

We have read the Strategic Energy & Water Plan for our University. The plan, as presented, supports the reductions required in G.S. 143-64.12(a).

Implemented this 7th day of September 2018.

Energy Analyst	Director of Facilities Operations	Associate Vice Chancellor for Facilities

Facilities Department
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