



2020 Strategic
Energy and Water Annual Report

August 31, 2020
Facilities Operations
Prepared by: Nihal Raees



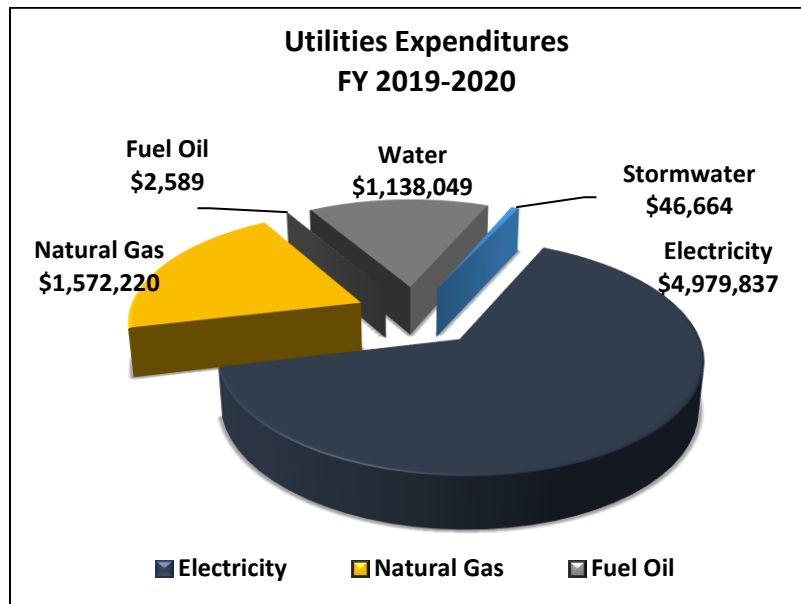
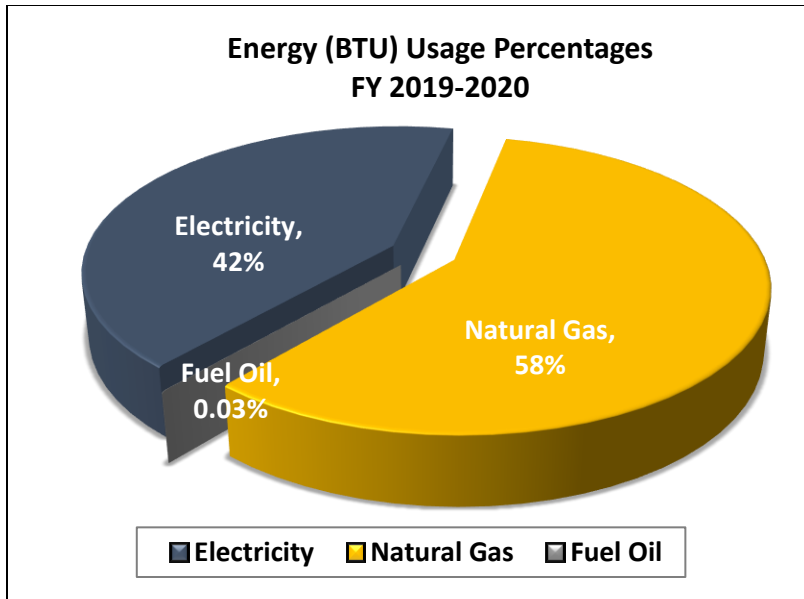
I. OVERVIEW

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 at UNCG have decreased significantly since the baseline year FY2002-2003 designated by the State. This report provides a top-level description of the campus utilities infrastructure and an update on campus progress towards utility reduction goals with projects already implemented and those planned for next year.

UNCG continues to reduce utilities consumption and expenditures despite the increase in student counts and campus building square footage. From the baseline year 2003, student enrollment FTE increased from approximately 12,000 to over 18,000 full-time equivalent students in 2020. The campus footprint also recorded a 50% increase with over 2 million gross square feet additional indoor spaces.

II. SUMMARY OF FISCAL YEAR 2019-20:

- The University expended all but \$52 of the \$788,574 in the Utility Savings Carry Forward Program, HB 1292, for FY19-20. \$500,000 (63% of total funds) was used for upgrading an obsolete Steam Plant main control system, burner controls for (4) boilers, and to integrate the plant to the BAS/Tridium system. The rest of the USCF funds were used to replace old/failing HVAC equipment with new more efficient equipment.
- Lexington and McCormick Residence Halls obtained LEED Silver certification. Along with those two buildings, UNC Greensboro has 24% of its total campus buildings area as LEED Gold/Silver certified which includes 9% Gold.
- The Ragsdale-Mendenhall Residence Hall major building renovation was completed. The work included replacing window air conditioners with a new HVAC system and connecting the building to the campus chilled water loop to serve this facility's cooling load.
- A Connect NC Bond construction project of \$105 million to build the South Chiller Plant (SCP) and the Nursing and Instructional Building (NIB) will be completed in Fall 2020. The SCP has two 1,500-ton chillers with 3,000-ton current capacity and is designed for five chillers 7,500-ton ultimate cooling load capability. The NIB is approximately 190,000 GSF and is expected to achieve an Energy Use Intensity (EUI) of 93 kBtu/GSF based on the designer energy model.
- In response to COVID-19 special operation hours aiming to cut utility consumption and cost, Dicky Hawks, the new Utilities Manager, and his team revised the occupied/unoccupied buildings' schedule to reflect the significantly reduced occupied hours.
- The University's total utilities expenditures for FY2019-20 were \$ 7,739,359 (Electricity: \$ 4,979,837 for 78,056,797 kWh; Natural Gas: \$ 1,572,220 for 3,676,837 therms; Water: \$ 1,184,712 for 130,135 kgal; and \$ 2,589 for 1,292 gal of #2 fuel oil).



III. UTILITY USAGE

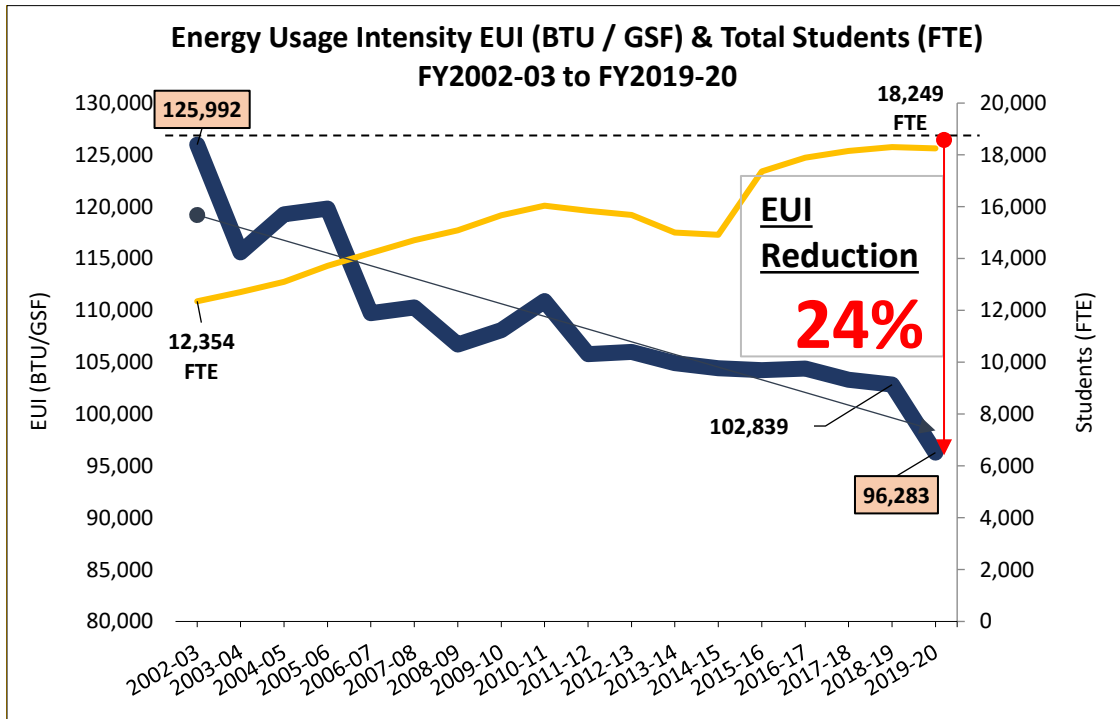
UNC Greensboro currently stands at an overall campus Energy Use Intensity (EUI) of 96,283 BTU/GSF/year, which represents a 24% reduction compared to the FY2003 baseline year. Although UNCG has not achieved the 30% EUI reduction State goal by FY2015, the University has dropped below 100,000 BTU/GSF/year after starting at 125,992 BTU/GSF/year. FY2020 total (electricity, natural gas, and water) utility cost per square foot had an 11% reduction from \$1.31 to \$1.17/GSF versus FY2019, and a 9% reduction compared to the baseline year. The reduced operating/occupied hours of campus facilities resulting from the response to COVID-19 significantly helped the University achieve this reduction.

Fiscal Year	Area	Utilities	Utility/Area	Energy	Energy/Area	Energy	Energy Cost
	GSF	\$	\$/GSF	\$	\$/GSF	MMBTU	\$/MMBTU
2002-03	4,269,699	5,537,461	1.30	4,990,987	1.2	537,824	9.3
2003-04	4,942,520	6,085,348	1.23	5,527,654	1.1	571,384	9.7
2004-05	4,987,544	6,878,519	1.38	6,248,603	1.3	594,916	10.5
2005-06	5,177,689	8,455,503	1.63	7,622,474	1.5	620,424	12.3
2006-07	5,415,496	7,674,070	1.42	6,884,414	1.3	602,349	11.4
2007-08	5,415,496	8,500,093	1.57	7,593,983	1.4	597,302	12.7
2008-09	5,415,496	7,906,663	1.46	6,861,603	1.3	577,867	11.9
2009-10	5,415,496	7,713,099	1.42	6,530,241	1.2	585,475	11.2
2010-11	5,551,245	7,653,606	1.38	6,753,156	1.2	615,587	11.0
2011-12	5,510,548	7,402,485	1.34	6,663,983	1.2	582,985	11.4
2012-13	5,716,735	7,571,726	1.32	6,853,774	1.2	605,897	11.3
2013-14	5,999,437	8,034,092	1.34	7,234,731	1.2	629,295	11.5
2014-15	6,086,061	7,859,390	1.29	6,959,803	1.1	635,534	11.0
2015-16	6,163,784	7,776,021	1.26	6,783,434	1.1	642,376	10.6
2016-17	6,408,406	8,569,900	1.34	7,435,123	1.2	668,955	11.1
2017-18	6,531,155	8,621,691	1.32	7,521,794	1.2	674,606	11.1
2018-19	6,542,163	8,601,691	1.31	7,435,361	1.1	672,766	11.1
2019-20	6,586,747	7,739,359	1.17	6,554,646	1.0	634,193	10.3
% Change (1-Year)	1%	-10%	-11%	-12%	-12%	-6%	-6%
% Change from Baseline	54%	40%	-9%	31%	-15%	18%	11%

Key Performance Indicators (KPI).

Key Performance Indicators KPI			Energy					Water		
Fiscal Year	Area	Students	Total Energy	Energy Cost	Energy/Area	Energy/FTE	EUI	Water	Water/Area	Water/FTE
	GSF	Eq. FTE	MMBTU	\$	BTU/GSF	MMBTU/FTE	BTU/GSF	Gal	Gal / GSF	Gal / FTE
2002-03	4,269,699	12,354	537,824	4,990,987	125,963	44	125,963	336,408,512	79	27,231
2003-04	4,942,520	12,708	571,384	5,527,654	115,606	45	115,606	290,356,396	59	22,848
2004-05	4,987,544	13,099	594,916	6,248,603	119,280	45	119,280	543,824,424	109	41,516
2005-06	5,177,689	13,723	620,424	7,622,474	119,827	45	119,827	175,592,520	34	12,795
2006-07	5,415,496	14,219	602,349	6,884,414	111,227	42	111,227	154,828,520	29	10,889
2007-08	5,415,496	14,704	597,302	7,593,983	110,295	41	110,295	155,922,844	29	10,604
2008-09	5,415,496	15,097	577,867	6,861,603	106,706	38	106,706	171,504,432	32	11,360
2009-10	5,415,496	15,670	585,475	6,530,241	108,111	37	108,111	183,458,968	34	11,708
2010-11	5,551,245	16,036	615,587	6,753,156	110,892	38	110,892	141,496,916	25	8,824
2011-12	5,510,548	15,841	582,985	6,663,983	105,794	37	105,794	122,794,672	22	7,752
2012-13	5,716,735	15,683	605,897	6,853,774	105,987	39	105,987	130,566,923	23	8,325
2013-14	5,999,437	15,009	629,295	7,234,731	104,892	42	104,892	123,906,620	21	8,256
2014-15	6,086,061	14,915	635,534	6,959,803	104,424	43	104,424	126,757,984	21	8,499
2015-16	6,163,784	17,365	642,376	6,783,434	104,218	37	104,218	133,052,004	22	7,662
2016-17	6,408,406	17,891	668,955	7,435,123	104,387	37	104,387	143,057,700	22	7,996
2017-18	6,531,155	18,153	674,606	7,521,794	103,290	37	103,290	132,712,640	20	7,311
2018-19	6,542,163	18,303	672,766	7,435,361	102,835	37	102,835	131,447,729	20	7,182
2019-20	6,586,747	18,249	634,193	6,554,646	96,283	35	96,283	130,134,944	20	7,131
% Change (1-Year)	1%	0%	-6%	-12%	-6%	-5%	-6%	-1%	-2%	-1%
% Change from Baseline	54%	48%	18%	31%	-24%	-20%	-24%	-61%	-75%	-74%

Decreased EUI (BTU per GSF) by 24% compared to baseline year FY2003.



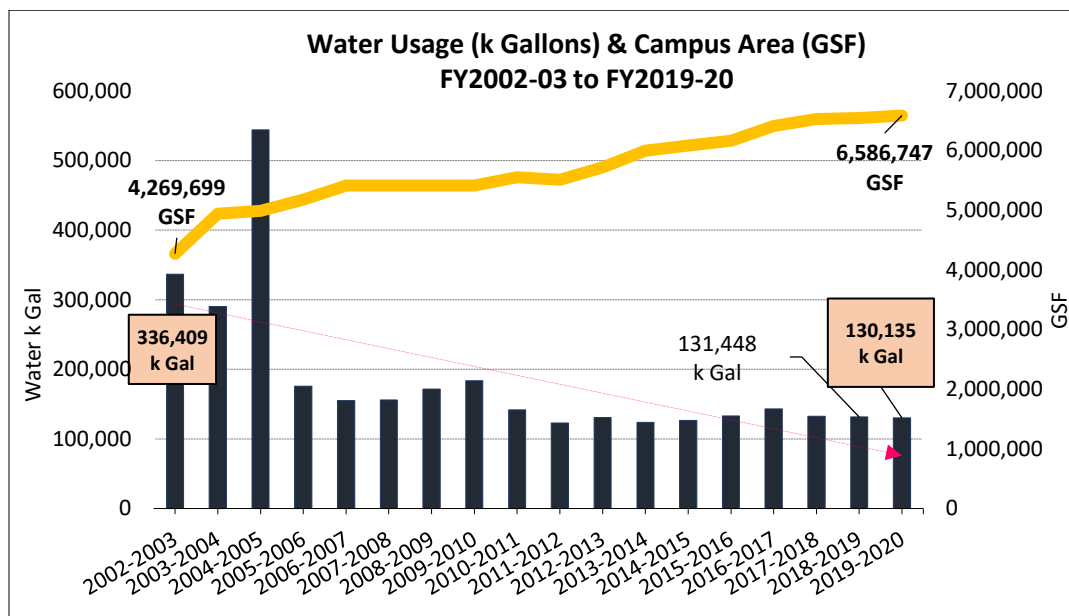
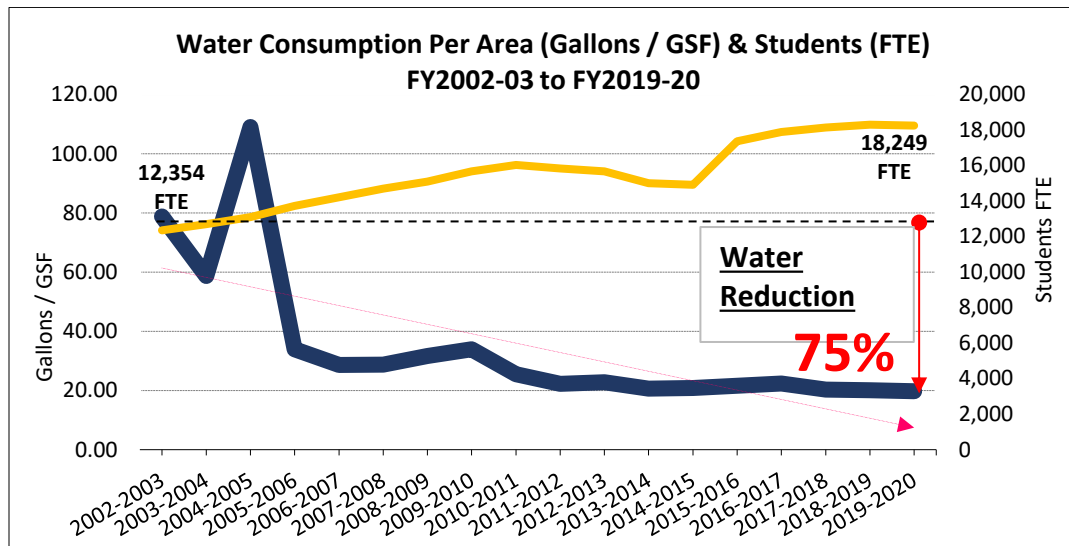
IV. BASELINE UTILITIES OVERVIEW

- WATER

UNCG receives water and sewer service from the City of Greensboro. The University owns and maintains 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 data is subsequently entered into a database. Where water is used for irrigation or cooling towers, submeters have been installed so that the University can take monthly meter readings of water that does not enter the sanitary sewer system in order to receive appropriate credits from the City of Greensboro.

UNC Greensboro has made tremendous progress in reducing water consumption. UNCG's Facilities organization 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 75% reduction in water consumption (per GSF) since the baseline year, FY2003.

Decreased water consumption (Gal per GSF) by 75% compared to the baseline year FY2003.

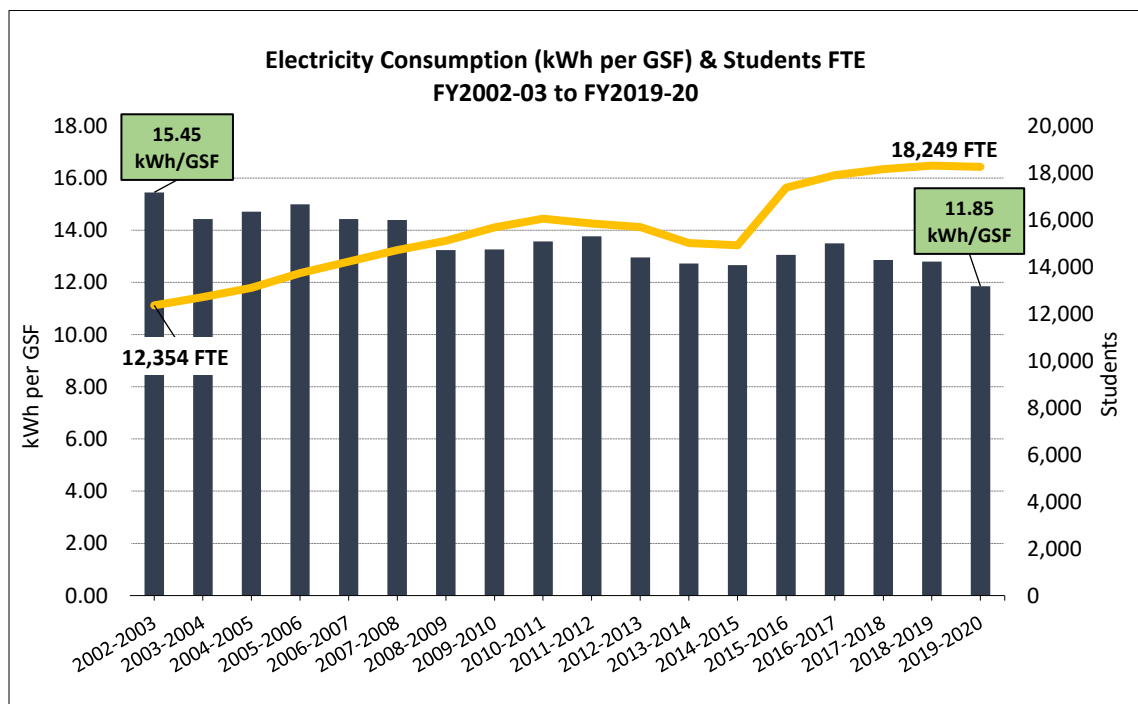
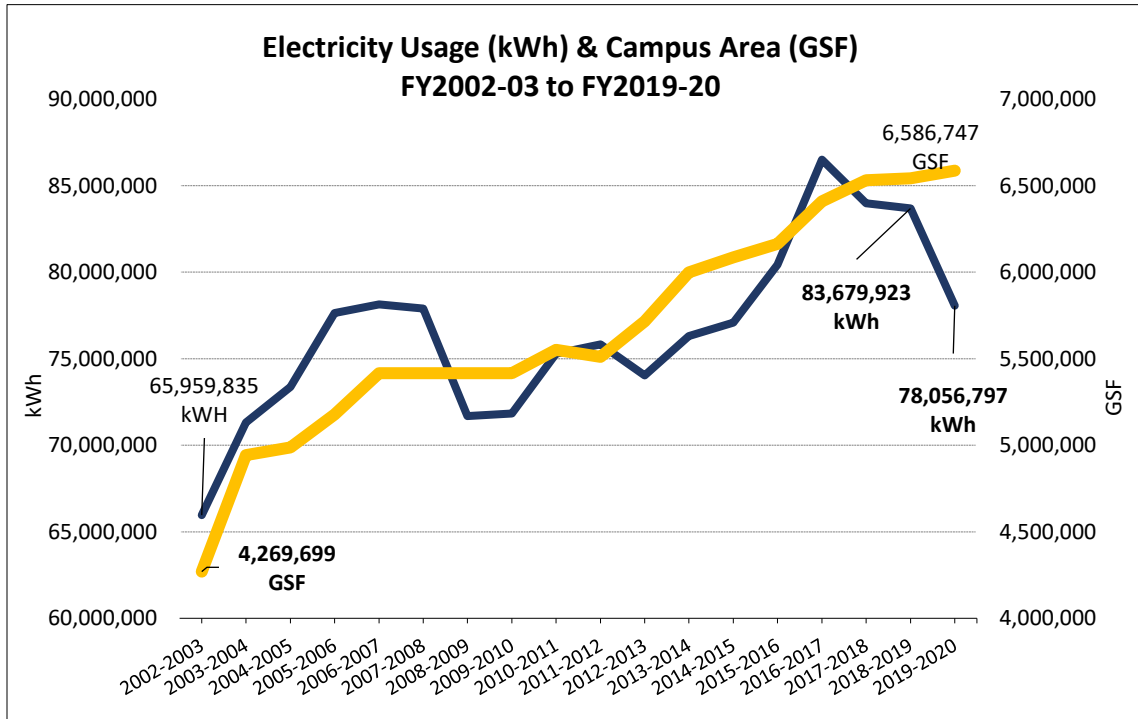


- ENERGY (Electricity, Natural Gas, and #2 Fuel Oil)

Electricity: Duke Energy provides electric power to UNCG facilities through over a hundred accounts. By far the largest account is the main campus substation that feeds an underground medium voltage electrical distribution system connected to more than 60 buildings. 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. In addition to reviewing the main substation account, all other UNCG accounts with Duke Energy are evaluated for best rate options on an annual basis. All buildings served by the substation have electricity submeters that are read monthly and the values are entered into a database. UNCG has taken steps toward automating the UNCG-owned meter reading process by giving the UNCG meter readers a comprehensive electronic form using

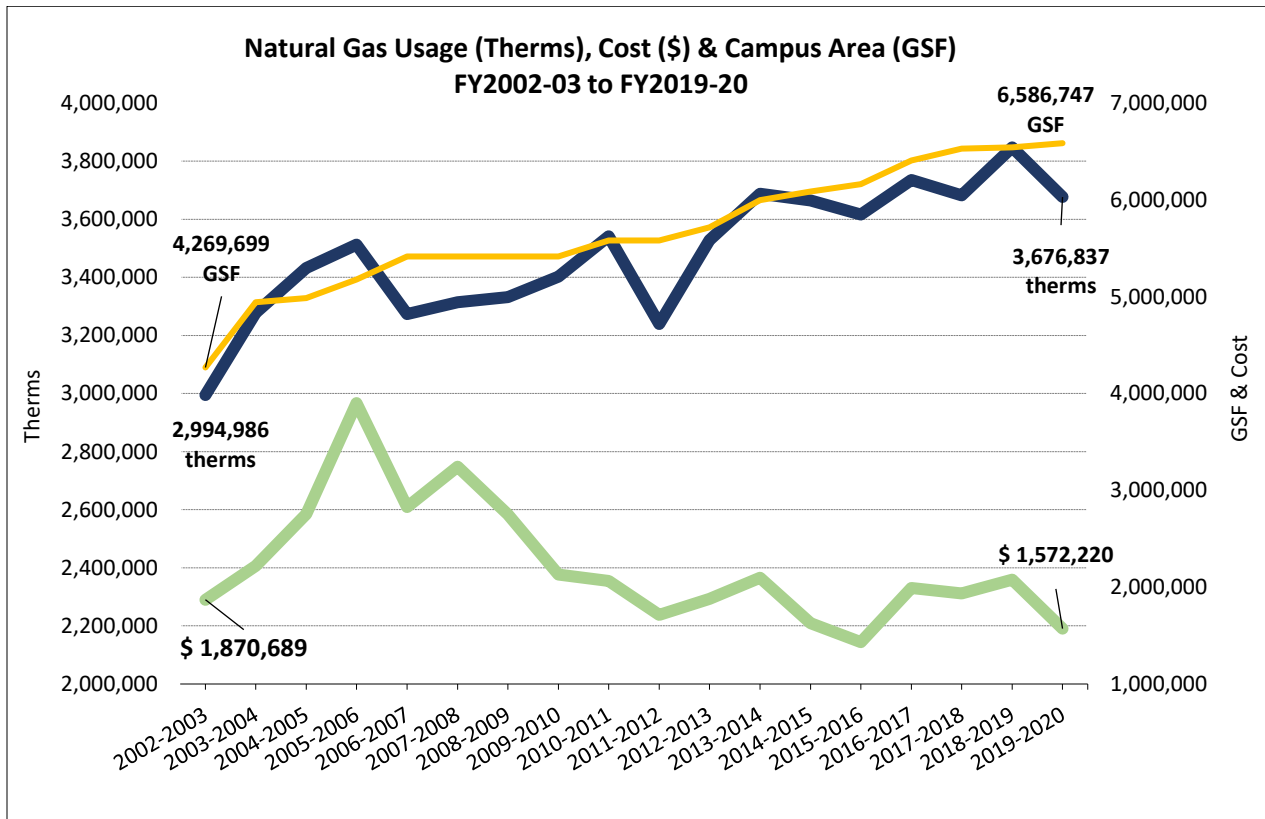
an iPad with Google Sheet. The new approach is more efficient because it replaces using the cumbersome Logbook where the meter readers had to write down each meter reading which was subsequently manually entered by others into a spreadsheet.

In FY2020, the total electricity bill for the campus was \$4,979,723 for 78,056,797 kWhs, which represents 11.85 kWh per GSF, and 4,277 kWhs per FTE student. FY2020 shows a 23% reduction in kWhs per GSF when compared to the baseline year (15.45 kWh/GSF), and a 7% reduction versus FY2019.



Natural Gas: Natural Gas for the Steam Plant is purchased through State Term Contract 405N, which is currently held by Texican Natural Gas Company, LLC. Piedmont Natural Gas (PNG) provides service to the campus and outlying properties. Complying with the N.C. Gen. Stat. § 105-164.13(52) which provides tax exemption to State agency accounts, all University natural gas accounts are tax free.

In FY2020, the total natural gas expenditures were \$1,572,220 for 3,676,837 therms, that reveals a 24% increase over the baseline year in actual therms, and a 4% reduction of 170,953 fewer therms when compared to FY2019. Natural gas consumption of 55,822 BTU/GSF represents a 5% reduction versus last year and 20% reduction when compared to FY2003 (70,145 BTU/GSF). Natural gas energy per students is at 20.1 MMBTU/FTE, which is a 4% reduction compared to FY2019 and a 17% reduction versus the baseline year.



No. 2 Fuel Oil: UNCG 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. In FY2020, UNCG used only 1,292 gallons of No. 2 fuel oil at the Steam Plant for tuning and testing the boilers and not for backup purposes since PNG did not interrupt gas service to UNCG during FY2020.

- STEAM AND CHILLED WATER

Steam: The University uses purchased power and natural gas to create chilled water and steam that are distributed to the campus. Steam goes to a total of 62 buildings on the main campus. The UNCG Steam Plant has four boilers with 190,000 pounds per hour (PPH) total capacity. Steam distribution capacity covers the campus steam peak load even when including the new under-construction Nursing and Instructional Building. The on-going Steam Plant Controls Upgrade project (\$500,000 funded by FY2020 USCF) replaced the outdated boiler controls, burner management system, and master controller. Limited funding did not allow for combustion air fan motor replacement and one feedwater pump VFD upgrade that could further reduce electricity usage.

Much of the campus steam infrastructure and piping system is 50 years old. The system has been periodically serviced in response to failures or normal wear and tear, and sections need a full replacement. UNCG has replaced three different sections over the years as funds were available. In Summer 2019 Phase-4 project was planned to replace steam and condensate pipes, manhole refurbishment and all associated sitework from manholes #73 to #74 (EUC to Bryan Building Service Drive at Theta Street). Part-A of the project was completed between the Elliott University Center and Sterling St. Funding was not available to complete Part-B upgrading the system between Sterling St. and the Bryan Building. In the current Campus Master Plan being updated by Affiliated Engineers and Sasaki, UNCG has included five (5) high-priority steam projects of \$3.9 million estimated cost to replace and renew critical portions of the steam distribution system.

In FY 2020 the Steam Plant produced 272.3 million pounds of steam to serve over 2.1 million assigned GSF (~60% of buildings GSF). The one-year change showed a 4% 11.4 million pounds reduction compared to prior fiscal year. FY 2020 registered 38.4 million pounds (16%) increase over the baseline year. That increase in steam production covered an additional 144,681 assigned building GSF comprising Moore Humanities and Research Administration, Gatewood Studio Arts Building, School of Education Building, and an expansion of the Gove Student Health Center. Energy and water cost of steam production can be reduced further if UNCG has the funds to move forward with replacing the critical portions of the steam and condensate distribution system.

Chilled Water: The McIver Chiller Plant (4 chillers with 6,000-ton total capacity) produces chilled water to serve HVAC needs in 42 buildings. In Summer 2020, Ragsdale-Mendenhall Residence Hall was connected to the campus chilled water loop to serve this facility's cooling load.

In Fall 2020 UNCG is expected to have the new constructed South Chiller Plant (2 chillers 3,000-ton current capacity) been designed for five chillers with 7,500-ton ultimate capacity. However, on August 7, 2020 the new South Chiller Plant began operating to continuously support the campus chilled water loop with 3,000-ton baseload capacity.

The updated Campus Master Plan by AEI and Sasaki shows the current summer 2020 demand is approximately 6,200 tons and include a partial load at Nursing and Instructional Building for construction phase cooling and the addition of Ragsdale-Mendenhall Residence Hall on the chilled water system.

Most buildings connected to the Steam Plant and Chiller Plants 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. So far, USCF funds have been used to install 7 steam meters in State appropriated funded accounts. Facilities Operations uses an assigned buildings gross square footage to allocate the total steam and chilled water cost for each entity.

The following is a List of all buildings constructed or acquired and renovated since June 30, 2003.

Sullivan Science Building
Oakland Parking Deck
1605 Spring Garden Street Building
Softball Stadium Complex
Recreational Field Support Building
Moore Humanities and Research Administration Building
Gatewood Studio Arts Building
Spring Garden Apartments
Baseball Locker Room and Training Facility
School of Education Building
Gove Student Health Center Renovation and Addition
Lofts on Lee Residences
Jefferson Suites
Haywood Residence Hall
Union Residence Hall
Lee Residence Hall
Highland Residence Hall
UNCG Police Building
Leonard J. Kaplan Center for Wellness
Lexington Residence Hall
McCormick Residence Hall
326 Tate Street Building
328 Tate Street Building
840 Neal Street Building
821 South Josephine Boyd Street Building
812 Lilly Avenue Building
842 West Gate City Blvd. Building
South Chiller Plant (FY2020-21)
Nursing and Instructional Building (FY2020-21)

- ENERGY DATA MANAGEMENT & BAS

UNCG collects energy consumption and billing information on a monthly basis for all buildings or facilities not served directly by utility companies. Currently, meters are still 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 Operations 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 65 buildings on the Tridium Building Automation System (BAS). In FY2018-19, UNCG finished moving all buildings from the older Signal building automation system to Tridium Niagara AX JACEs including the Housing and Residence Life buildings.

V. SUSTAINABILITY & ENERGY

In FY2020, UNCG completed an exterior pole lighting conversion project using a \$17,682 grant from the UNCG Green Fund for the parts and labor to replace 57 High Pressure Sodium bulbs to LEDs on College Avenue. The Grounds Department was also granted \$7,296 to install a smart irrigation system on the softball and baseball fields. The Green Fund also awarded \$11,000 to install 4 Level-2 Electric Vehicle (EV) Charging Stations in the McIver Parking Deck. A previous Green Fund project installed 9 Level-1 & 2 EV charging stations in the Oakland Parking Deck.

In October 2019, the Green Fund granted \$70,257 (over 4 years) to lease and install (6) Big Belly network-connected waste and recycling receptacles to serve College Ave., which is the highest traffic pedestrian route on campus. The Big Belly receptacles improve the efficiency and management of campus waste and recycling solutions.

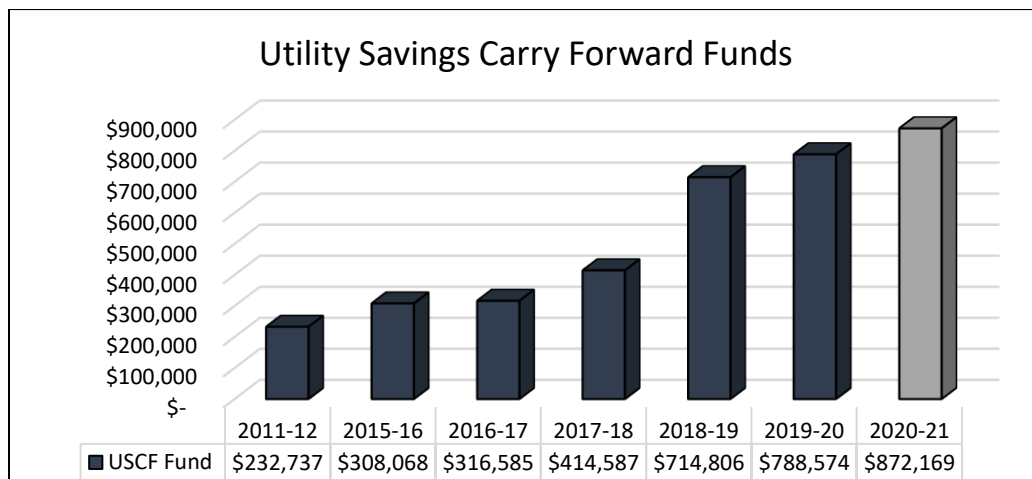
VI. PROJECTS AND ENERGY SAVINGS

To achieve energy consumption and utilities cost reduction goals, UNC Greensboro focuses first on low- and no-cost energy conservation measures (ECMs). The HB 1292 Utility Savings Carry Forward (USCF) program is used as a main resource to support energy saving projects.

UNCG started reporting/requesting the USCF credits in FY2011. The USCF funds in 2012 was around \$232,737 with no ESCO savings (\$7.2 million PC in 2008) since the guaranteed energy savings contract pre-dated the HB 1292 legislation. FY2016 approved/executed funds were \$ 308,068, which increased to \$788,574 in FY2020 and \$872,169 in FY2021.

UNC Greensboro plans ahead to get the best of the program and spend the entire USCF amount before it disappears by the end of the fiscal year. In the last three years, over 99% of the approved/funded amount was spent leaving only \$52 balance.

Utility Savings Carry Forward funds (HB1292 / General Statute 143-64.12(a)) will continue to be invested in energy conservation measures to achieve the University and State energy reduction goals. In addition, the fund will back up the Repair and Renovation R&R funds in replacing failed and outdated HVAC equipment with more energy efficient equipment in State-supported facilities. The funds will also support other critical projects on campus such as repairing steam/condensate leaks in the steam distribution system.



FY2020 projects included the following:

<u>Projects FY2019-20</u>	<u>Building</u>	<u>Description</u>	<u>\$ Amount Assigned</u>	<u>Simple kWh Payback</u>	<u>Est. Savings MMBTU</u>
Steam Plant Controls Upgrade	Steam Plant	Upgrade Steam Plant Control System Including Burner Controls and BAS integration	500,000	5.4	16,929
Contract Retro-Commissioning	Graham, Eberhart, and Studio Arts	Includes verifying proper operation of HVAC systems, including economizer cycles, and calibrating sensors and controls equipment	50,000	1.7	1,542
Auditorium LED Upgrade	Ferguson Building	Install nLight dimmable LED fixtures and switches.	25,000	2.3	58
Steam Meters	Music Building & Taylor Theatre	Install Campus standard Spirax Sarco TVA steam meter and integrate it to the BAS	25,000	N/A	N/A
Chiller Replacement	Chemical Safety	Replace a 1994 Air-cooled Reciprocating Chiller (20 ton) with New Scroll Chiller	50,000	44.7	58
Chiller Replacement	1100 West Market St. Building	Replace a 1997 Air-cooled Reciprocating Chiller (100 ton) with New Scroll Chiller	95,000	16.8	245
Rooftop Unit Replacement	North Drive Child Care	Replace Cooling-only Rooftop Unit w/Packaged (include Heating) Unit	43,574	62.3	36
Total			\$ 788,574		18,868

FY2021 Approved list of projects:

FY 2020-21 Utility Savings Carry Forward Projects							
\$ 872,169		Maximum amount of money (the amount requested - USI/OSBM)					
\$ 523,301		to be spent in energy/utility saving projects					
\$ 348,868		to be spent in any project not related to energy/utility savings					
						Approved	8/24/2020
Project #	Project	Building	Description	Budgeted Dollars	Payback (Years)	Estimated Savings BTU	Project Manager
1	Replace Chiller Module #2	Bryan Building	Replace the failed Module #2.	\$ 85,000	-	-	Denny
2	Rooftop Unit Replacement	University Graphics & Printing	Replace the existing RTU.	\$ 25,000	19.2	56,000	Denny
3	Replace Split System A/C	Campus Supply Store	Replace the existing split air-conditioning system.	\$ 30,000	18.5	85,000	Denny
4	Campus-Wide Steam Distribution	Steam MH 11 - MH 12 Next to College Ave.	MH 11 - MH 12. Inspect, repair and re-insulate a leaking steam line.	\$ 257,169	15.4	1,652,350,795	Dicky
5	Replace Cooling Tower	Bryan Building	Replace the existing cooling tower.	\$ 100,000	-	-	Denny
6	Rooftop Units Replacement	Becher Weaver	Replace (9) Lennox gas/electric RTUs including better controls added to the building.	\$ 150,000	19.4	330,000	Denny
7	VAV Controls Upgrade	Sink Building / Second Floor	Replace VAV boxes not responding to control.	\$ 75,000	-	-	Denny
8	Replace DX System	McNutt Building	Replace Machine Room DX System (Data Aire)	\$ 150,000	6.8	1,187,738	Denny
Totals				\$ 872,169		1,654,009,533	

VII.GOALS

UNC Greensboro is expanding in students and staff head counts, in addition to the increase in campus indoor footprint. Since the baseline year, FY2003, the campus GSF has increased by 54%. However, during that same time period, UNCG has decreased its Energy Use Intensity by 24%. As of FY 2020, the University has achieved a 75% reduction in water gallons/GSF surpassing the State water reduction mandate.

UNCG supports the State greenhouse gas emissions goal of 40% reduction below 2005 levels. An official 2018 UNCG greenhouse gas emission report showed a reduction of 8% from 2009 levels (as far back as the inventory goes). Achieving a decrease of 24% MTeCO₂ per 1000 gross square feet and a decrease of 18% MTeCO₂ per weighted campus user.

Despite budgetary constraints, and not reaching the 2015 energy reduction mandate, UNCG will continue embracing Executive Order 80 and UNC System energy goals. 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. Efforts to reduce UNCG's per square foot energy consumption will continue, guided by the UNCG Climate Action Plan and the responsible stewardship approach of the Facilities Operations Energy Management Team.