Comprehensive Program to Manage Energy, Water, and Other Utility Use for State Agencies and State Institutions of Higher Learning

A Report to

Governor Roy Cooper

Pursuant to Executive Order No. 80, Section 8

December 1, 2022

Prepared by:

North Carolina Department of Environmental Quality

State Energy Office

Utility Savings Initiative

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Preface:

This report contains the Department of Environmental Quality's status update to Governor Cooper for the Comprehensive Energy, Water, and Utility Use Conservation Program pursuant to Executive Order No. 80, Section 8.

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List of Acronyms

Abbreviation	Definition
BAS	Building Automation System
Btu	British Thermal Unit
DEQ	Department of Environmental Quality (formerly DENR)
DHHS	Department of Health & Human Services
DIT	Department of Information Technology
DMVA	Department of Military & Veterans Affairs
DNCR	Department of Natural & Cultural Resources
DOA	Department of Administration
DOC	Department of Commerce
DOI	Department of Insurance
DOJ	Department of Justice
DOR	Department of Revenue
DOT	Department of Transportation
DPI	Department of Public Instruction
DPS	Department of Public Safety
ECM	Energy Conservation Measure
EO80	Executive Order 80
ESCO	Energy Service Company
EUI	Energy Use Intensity
FCAP	Facility Condition Assessment Program

Abbreviation	Definition
FY	Fiscal Year
GESC	Guaranteed Energy Savings Contract
GHG	Greenhouse Gas
GS	General Statute
Gsf	Gross Square Foot
HB	House Bill
HVAC	Heating, ventilation, & air conditioning
kW	Kilowatt
kWh	Kilowatt Hour
LED	Light Emitting Diode
LGC	Local Government Commission
MM	Million
$MTCO_{2e}$	Metric Tons of Carbon Dioxide Equivalent
NCCCS	North Carolina Community College System
OSBM	Office of State Budget & Management
SB	Senate Bill
SEO	State Energy Office
SL	Session Law
UNC	University of North Carolina
USI	Utility Savings Initiative

1.0 Executive Summary

North Carolina General Statute (GS) §143-64.12 requires the State Energy Office (SEO) to develop a comprehensive program to manage energy, water, and other utility use for state agencies and state institutions of higher learning. The statute required all state-owned buildings to reduce energy usage intensity (EUI)[1] by 30% of fiscal year (FY) 2002-03 levels by 2015. On October 29, 2018, Governor Cooper issued Executive Order No. 80 (EO80) which extends these energy saving goals and requires a 40% FY2002-03 EUI reduction by 2025.

As part of these mandates, the Utility Savings Initiative (USI) program within the SEO was founded to annually collect utility consumption reports from state agencies, University of North Carolina (UNC) System schools and affiliates, and community colleges. The data collected from these governmental units is utilized to generate a report that describes the Comprehensive Energy, Water, and Utility Use Conservation Program (i.e., the "Comprehensive Program") along with a summary of efficiency gains as required every odd numbered year by statute. Additionally, in accordance with EO80, an annual status update is required for each cabinet agency's utility consumption, costs, and progress in reducing energy consumption. The purpose of this report is to meet EO80 requirements by summarizing the collective progress of state-owned buildings towards the 40% reduction goal. This report also includes recommendations for further actions that may be accomplished to meet the EO80 goal for state buildings.

Before moving forward, USI needs to clarify that previous reports contained both methodology and data entry errors that impacted FY2002-03 DOA baseline values. These errors lead to the -9% EUI in last year's report that was ultimately corrected to a -40% EUI for this fiscal year (FY2021-22). DOA energy managers and DEQ energy engineers worked together to ultimately correct the baseline values (FY2002-03) with historical building-level utility data that followed the United State Department of Energy's (USDOE) Better Buildings Challenge (BBC) guidelines (see Appendix F). These guidelines suggest that buildings no longer in DOA's current portfolio be removed from the baseline (i.e., usage and GSF were not included). Due to these circumstances, the adjusted EUI is not attributed to implementing significant energy conservation measures between FY 2020-21 and FY 2021-22.

Additionally, DEQ would like to note that the Wildlife Resource Commission (WRC) and the UNC School of the Arts did not report data for the baseline year (FY2002-03). It was verified that WRC campus was not live until FY2005-06, and thus, based on the USDOE's BBC methodology, was not included in baseline calculations for 'other' agencies. Although the UNC School of the Arts campus was live at the baseline year for reporting, data is not available until FY2005-06. Assuming no energy savings initiatives were made between FY2002-03 and FY2005-06, data from the first year of reporting was used as a proxy for UNC School of the Arts baseline energy usage.

[1] *Represents energy consumption per gross square foot (Btu/gsf)*

State-Owned Buildings Energy Use Intensity Reductions to Date

Accounting for all state-owned buildings includes utility consumption by cabinet agencies, other state agencies, and the University of North Carolina (UNC) System.[2] Collectively, for FY2021-22, all state-owned buildings attained an overall 32% reduction in EUI from the 2002-03 baseline. This is below the trajectory of achieving the EO80 goal by 2025 without significant and immediate monetary investments to implement energy conservation measures. Table 1 summarizes EUI reductions to date for cabinet agencies, other agencies, the UNC System, and the combined total for all state governmental units. This data emphasizes that significant energy conservation measures and resources are needed by all state sectors in order to achieve the EO80 40% EUI reduction goal by 2025.

Table 1: State Government Buildings Energy Efficiency Gains (FY03-FY22)

Participant		Cabinet Agencies	Other Agencies[1]	UNC System[2]	State Governmental Units Total
Gross Square Footage	**% Change**	+24%	+40%	+63%	+48%
Energy Usage Intensity (Btu/square foot)	**% Change**	-31%	-16%	-35%	-32%

[1]The main WRC campus was not built until 2005-06, and thus, is not included in baseline (FY03)

[2]UNC School of the Arts data was not reported prior to FY2005-06 and was assumed to be constant for all fiscal years prior

Within state governmental units, the UNC system is a major contributor since they account for 72% of all energy consumed, 66% of the total gross square footage, and 70% of all utility spending. Fortunately, they have also proven to be the pinnacle of energy management considering that the UNC system currently shows a 35% reduction in EUI from the 2002-03 baseline. This accomplishment occurred despite increasing square footage by 63% over the same timeframe. Many UNC System constituents have designated full-time energy managers or energy management teams that consistently review bills, make energy retrofits, take advantage of federal or state funding opportunities, and plan for future initiatives. Such practices resulted in avoided utility costs of over $138 million for the UNC System alone in FY2021-22. In addition, cumulatively, the UNC System has avoided $1.43 billion in utility costs since the Comprehensive Program began. Avoided utility costs represent the amount that would have been paid if energy efficiency retrofits or upgrades were not implemented. The UNC system makes up approximately 78% of avoided utility costs for FY2021-22 and sets an example for all state agencies; therefore, the utility management plans of the highest performing UNC System schools should be assessed to obtain insight into additional conservation measures that may be implemented. Western Carolina University, the UNC System Office, UNC Wilmington, Appalachian State University, UNC Pembroke, and Fayetteville State University all achieved

[2] *Excludes leased buildings whose utility bills are not paid by state governmental entities.*

EUI reductions of 40% or more this fiscal year (FY2021-22) compared to baseline (FY2002-03).[3]

The remaining totals for state governmental units consists of State agencies (both cabinet and other). Together, these agencies represent approximately 28% of state-building energy consumption, 34% of total state-owned square footage, and 30% of total state-owned utility spending. Since FY2002-03, agencies have avoided approximately $320 million in utility costs while their gross square footage has increased by 25%. Despite the lower rate of increasing square footage compared to the UNC System, agencies have not achieved EUI reductions to the same level. For example, cabinet agencies and other agencies have achieved a 31% and 16% reduction in EUI since FY2002-03, respectively. This shows that state agencies must improve their energy conservation efforts to make significant contributions to the EO80 goal that are relative to their size and energy usage levels. While smaller contributors, other agencies should achieve higher reductions since their conservation efforts still impact the collective state-owned building EUI. This report will recommend definitive steps that these agencies can make to achieve greater reductions in energy usage and costs.

While USI has collected annual utility consumption and cost data from community colleges since FY2007-08, their progress is not included in state-owned building metrics since they are considered local governmental units. This should not devalue the need for their energy conservation efforts since community colleges represent over 32 million gross square feet and $48 million in annual utility spending. Since their unique 2007-08 baseline, community colleges have achieved a 19% EUI reduction despite a 42% square footage increase. In addition, they have cumulatively avoided over $107 million in utility costs through implemented energy conservation measures. To further environmental stewardship and management of local taxpayer dollars, USI recommends that community colleges replicate successful efforts from the UNC System to reduce utility consumption and costs (i.e., hiring full-time energy managers).

Another topic to be discussed in this report is the effect of the pandemic on the energy data. Returning to in-person activities in FY2021-22 has led to an increase in energy usage for many state-buildings compared to FY2020-21. For example, the UNC System increased energy consumption by 399 billion Btus this FY compared to last. Upon discussions with local energy managers and facilities management, this increase may be attributed to increased human occupancy as well as COVID-19 safety precautions like additional outside air concentrations and denser filtration media for heating, ventilation, and air conditioning systems (HVAC). As social distancing practices decrease, these airflow and filtration additions are important public health measures to combat the spread of COVID-19.

Cost Savings and Air Pollution Benefits Related to Energy Conservation

While most energy efficiency projects require upfront initial investments, they are accompanied by a great deal of savings and avoided costs in future years. Table 2 summarizes utility costs and avoided costs for cabinet agencies, other state agencies, the UNC System, and a combined total for all state governmental units. Together these sectors spent nearly

[3] UNC School of Arts (UNC SA) energy data was not collected for FY2002-03, thus, its first reporting year (FY2005-06) was used as a proxy for FY2002-03. UNC SA is a small contributor to the UNC Systems energy usage. In FY2021-22, UNC SA made up only 1.4% and 1.2% of the UNC systems total GSF and BTU, respectively.

$325 million on utilities which equates to approximately $890,000 per day. Of course, this would have been $177 million higher in FY2021-22 without the avoided costs from energy efficient building upgrades. As the data shows, the Comprehensive Program has achieved $1.75 billion in savings for North Carolina's taxpayers since the FY2002-03 baseline. Further investments into building efficiency improvements towards the EO80 goal can result in additional millions of dollars in utility savings for all state-owned buildings. True savings may be higher due to rising fuel and electricity costs.

Table 2: State Government Buildings Energy Costs and Savings (FY03-FY22)

Participant	Cabinet Agencies	Other Agencies	UNC System	State Governmental Units Total
Actual Utility Costs (FY22)	$91 million	$7 million	$227 million	$325 million
Avoided Utility Costs (FY22)	-$37 million	-$2 million	-$138 million	-$177 million
Cumulative Avoided Utility Costs (FY03-FY22)	-$308 million	-$12 million	-$1.43 billion	-$1.75 billion

Energy efficiency improvements have also provided air pollution benefits by avoiding fuel combustion directly at the buildings or indirectly at central electric power stations. FY2021-22 estimates show that the program avoided 1,053,366 metric tons of carbon dioxide equivalent ($MTCO_{2e}$)[4] in greenhouse gas (GHG) emissions for state governmental units. Cumulatively since FY2002-03, approximately 9.1 million $MTCO_{2e}$ of GHGs have been avoided for state governmental units which is equivalent to annual CO_2 emissions from the electricity consumed in 1,773,948 homes or two coal-fired power plants.[5]

[4] *$MTCO_{2e}$ is metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential. Carbon dioxide equivalents are commonly expressed as "metric tons of carbon dioxide equivalents ($MTCO_{2e}$)."*

[5] *See Appendix B for sources and assumptions used in calculating greenhouse gas amounts.*

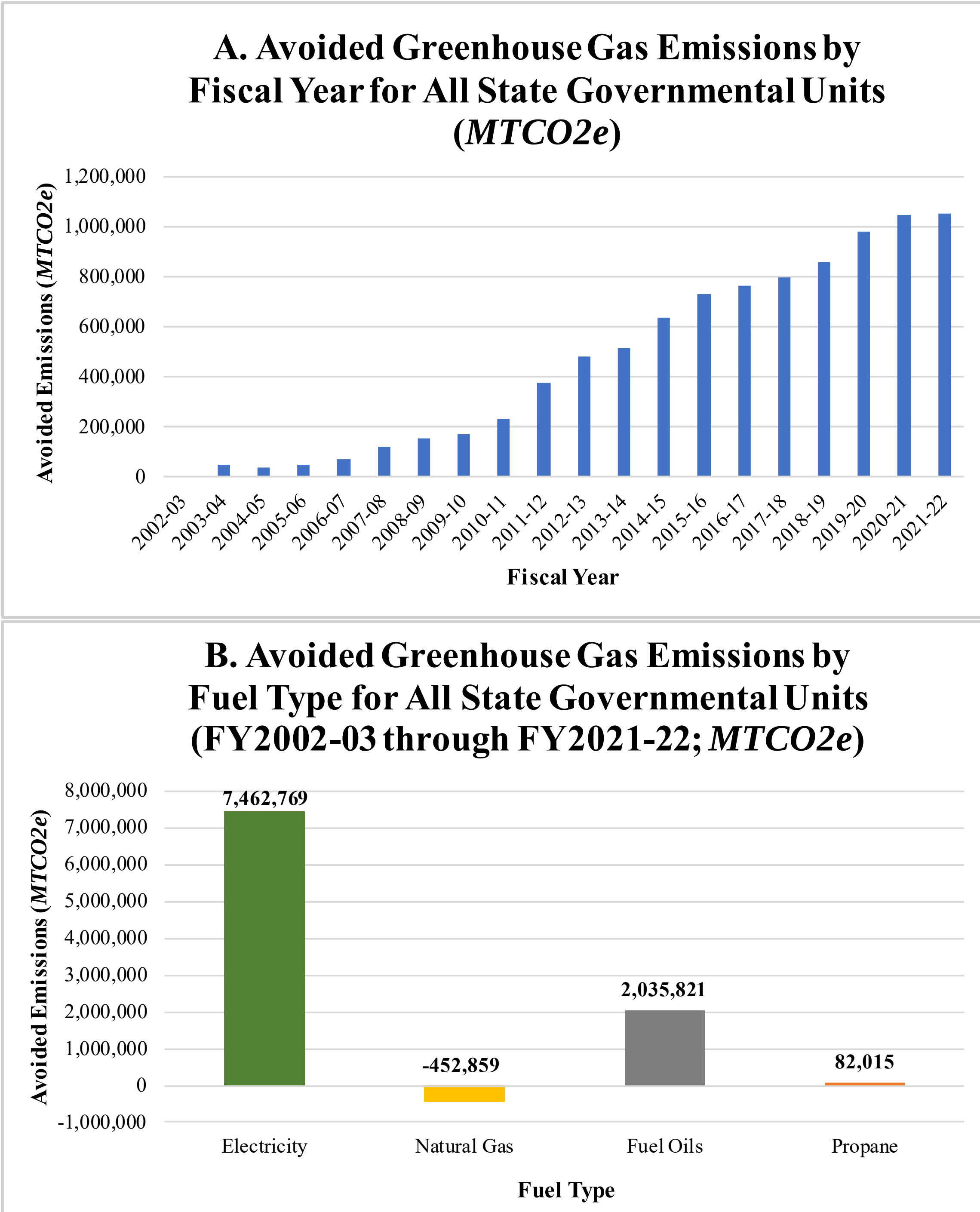

Figure 1: Avoided Greenhouse Gas Emissions for State Agencies and the UNC System *($MTCO_{2e}$)* by (A) year and (B) fuel type.

Cabinet Agency Energy Projections to 2025

Although the EO80 reduction goal is directed towards the collective efforts of all state-owned buildings, cabinet agencies should proportionately contribute to their share of the collective total. Separating cabinet agencies from the state-owned building total and evaluating individual efforts provides an estimate of additional energy reductions that are needed. This type of evaluation is critical to determine how each cabinet agency contributes to the cumulative total for state-owned buildings based on their individual EUI. With respect to these criteria, the SEO primarily worked with energy managers across the largest five cabinet agencies (i.e., DPS, DHHS, DOT, DOA, DNCR) to target 51 buildings and 103 energy efficiency projects that could be targeted to assist with equitably meeting the collective -40% EUI goal by 2025. Overall, the projects were inventoried under the following categories: (1) electrical upgrades [i.e., lighting]; (2) building envelope repairs [i.e., weatherization]; (3) mechanical upgrades [i.e., HVAC]; and (4) other [i.e., clean energy improvements, recommissioning, performance contracts].

Table 3 illustrates that the cabinet agencies are collectively projected to achieve a -44% EUI by 2025 through $59 million in anticipated performance contracts and $107 million in unfunded projects (a total EUI decrease of -13% relative to their current levels). This combined with the exemplary reductions from the UNC System would assist with meeting the EO80 goal by 2025.[6] The challenge is that that cabinet agencies will most likely need to leverage alternative funding opportunities, complete construction of identified projects one FY prior to 2025, assure that usage and gsf trends remain constant, and offset competing energy priorities from executive directives or anticipated legislation.

Table 3: Cabinet Agency Results from EO80 Projections

Cabinet Agency	FY2021-22 EUI Reduction	Estimated Reduction through FY2025 with Energy Projects	Performance Contract	Unfunded Project Amounts
DPS	-29%	-48%	$48MM	$22MM
DHHS	-36%	-42%	-	$28MM
DOT	-30%	-35%	-	$38MM
DOA	-40%	-46%	-	$7MM
DNCR	-35%	-49%	$11MM	$10MM
DIT*	+14%	+9%	-	$1MM
DOC**	-13%	-13%	-	-
DEQ*	-44%	-46%	-	$1MM
TOTALS	**-31%**	**-44%**	**$59MM**	**$107MM**

* Due to the smaller contributions of DEQ's and DIT's EUI to the collective total, it was assumed that $1MM in energy efficiency projects would reduce their raw Btu's by approximately 5%, respectively.
**DOC's sole facility reporting utilities was deemed surplus by DOA; therefore, no energy efficiency improvements were incorporated.

Recommendations to Meet the 40% Goal by 2025

USI consistently works with all government sectors to identify and to suggest energy efficiency improvements. Some of these improvements are well-defined such as increasing building envelope insulation or converting to LED lighting. Other improvements are more abstract and harder to gain support for implementation. This is where all governmental sectors need to focus in order to achieve greater EUI reductions. Energy efficiency prioritization, reinforcement, and funding are needed from upper management, the Governor's Office, and the legislature to meet the energy reduction goal. A prudent step would be integrating the EO80 directive into statute to provide more legislative authority regarding this work. In

[6] *This assumes that the UNC System is on the trajectory to independently achieve a -40% EUI by 2025 and that "other" agencies remain at their current -16% EUI by 2025.*

addition, shifting the focus towards broad energy management concepts will help ensure energy efficiency becomes a cultural change with long-term commitments. This includes concepts such as the following:

- Offsetting competing energy priorities *(i.e., electric vehicle charging infrastructure vs. energy efficiency improvements)* with clean and resilient energy solutions
- Designating full-time energy managers
- Investing in automated and universal data collection, reporting, and analysis system
- Considering alternative strategies for financing of energy projects
- Utilizing Guaranteed Energy Savings Contracts
- Ensuring the content in utility management plans meets USI's best practices
- Establishing a mandate against purchasing non-LED lamps or fixtures
- Evaluating whether to opt in or out of electric utility rebate programs
- Applying for federal grant or stimulus funding opportunities

To understand how operational and cultural changes are effective and ensure that the EO80 goal is achievable, state agencies can employ several methods used by the UNC System to reduce energy intensity. The UNC System utilizes full time energy managers, takes advantage of performance contracting, improves building controls, converts to LED lighting, looks for rebate opportunities, and continuously promotes and implements both large and small energy efficiency measures. It is recommended by the SEO that the same initiatives should be used by all governmental sectors.

In summary, without immediately investing and implementing substantial energy efficiency measures within the next fiscal year (i.e., FY2023-24), the EO80 goal will not be achieved. State and UNC System leadership must make the necessary changes in project priority, energy manager support, and energy program funding. The remainder of this report's narrative provides: the effects of COVID-19 on energy usage; background on the USI program; reporting requirements; recommendations for state governmental units to reduce energy consumption; and the conclusion. Additionally, the appendices to this report contain: (A) detailed agency-specific energy performance data; (B) sources and assumptions used to calculate greenhouse gas offsets; (C) utility management plans; (D) the text of EO80; (E) statutory authority; and (F) the US DOEs guidelines for the Better Buildings Challenge.

2.0 Effects of COVID-19 on Energy Usage

During FY2021-22, several reporting entities implemented hybrid telework arrangements as they rapidly transition to a modern work environment. Hybrid work environments are spreading across state governmental units and are expected to remain for years to come. In theory, hybrid work environments could reduce energy use requirements; however, health and safety measures utilized to combat COVID-19 generally increase energy usage in occupied buildings. For example, one recommendation was to increase the influx of outside air to heating and air-conditioned building spaces to at least the minimum rates based on applicable codes and standards.[7] When increased

[7] https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf

amounts of outside air are brought into a building, energy is required to condition that whole volume of air to the desired temperature. This requires significantly more energy than recirculating existing air that had already been conditioned inside the building. Another recommendation was to increase the filtration level used in heating and air conditioning systems to a Minimum Efficiency Reporting Value of 13.[8] Such filtration levels require more energy to force air through the filter media. Both approaches were commonly adopted in the public sector thereby resulting in increased energy usage; however, this is not a sustainable approach over the long-term without offsetting consumption with alternative generation sources such as rooftop solar photovoltaic. While some studies have investigated the trade-offs between residential and commercial office building energy analysis as more people work remotely,[9] the full impact will be better understood next year with additional data to benchmark against pre-pandemic office energy use.

While maintaining COVID-19 health and safety measures is paramount, the public sector must also be aware of usage patterns and continue looking for other approaches. Ultra-violet germicidal irradiation and bipolar ionization are two other technologies which can be implemented without a significant increase in energy usage. However, both technologies include caveats such as a potentially large initial investment[10] or generation of byproducts that impact indoor air quality,[11] respectively. Alternately, working with building schedules can mitigate energy usage with the increased outside air method of cleaning a space. If a room or building is to be occupied, a one hundred percent outside air "flush" for two hours prior and two hours after occupation has proven effective and uses less energy than just flushing the space around the clock.[12] This emphasizes that some compromise of technologies should be sought as opposed to accepting that higher energy use is the cost of combatting COVID-19.

3.0 Background on the USI Program

In February 2002, North Carolina's governor issued an executive order to create the *Commission to Promote Government Efficiency and Savings on State Spending*. At the time, the State was challenged with two sequential years of expenditures exceeding incoming revenue. By July 2002, the Commission recommended the establishment of a Statewide initiative for utility savings. Therefore, on July 17, 2002, North Carolina's Governor issued a memorandum to the Council of State members, Cabinet Secretaries, University of North Carolina (UNC) System president, and UNC Chancellors formally establishing the USI program in the State Energy Office.

Senate Bill 668 (Session Law 2007-546, Section 3.1.(a)) was a landmark bill that ratified the USI's goals, mission, and requirements into statute. The purpose of this action was to permanently promote energy efficiency, eliminate waste, and to reduce utility expenditures in state-owned buildings. The legislation required that State agencies and the UNC system develop and implement a management plan, as well as providing annual updates that are consistent with the

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[8] https://www.epa.gov/coronavirus/what-kind-filter-should-i-use-my-home-hvac-system-help-protect-my-family-covid-19#:~:text=Coronavirus-,What%20kind%20of%20filter%20should%20I%20use%20in%20my%20home,trap%20smaller%20particles%2C%20including%20viruses.
[9] https://doi.org/10.3390/su132111586
[10] https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation/UVGI.html
[11] https://www.epa.gov/coronavirus/can-air-cleaning-devices-use-bipolar-ionization-including-portable-air-cleaners-and
[12] https://www.ashrae.org/technical-resources/building-readiness

USI's Comprehensive Program. In addition, the legislation required that the energy consumption per gross square foot in all state-owned buildings be reduced relative to fiscal year 2003-04 levels as follows: (1) 20% by 2010; and (2) 30% by 2015. Furthermore, community colleges were required to submit an annual written report to the State Energy Office containing utility consumption and costs for review.

Senate Bill 845 (Session Law 2008-198, Section 11.1) revised the base fiscal year for the EUI reduction requirements in state-owned buildings to 2002-03 levels. The base year has remained unchanged since that time.

House Bill 1292 (Session Law 2010-196, Sections 1 and 2) permitted institutions in the UNC system to credit unused General Fund appropriations into the next fiscal year for realized energy savings accrued by implementing energy conservation measures. Of the savings achieved, 60% must be utilized for future energy conservation measures. The savings were designed not to affect the recommended continuation utility budget requirements by the Director of Budget. To receive the credit balance, affected institutions were required to submit annual updates to their utility management plans regarding the use of funds using the criteria in GS §143-64.12(a)(1) through (a)(4). For FY 2021-22, eleven UNC System schools asked to carry forward over $14.4 million in savings and reported spending an additional $9.2 million for new energy efficiency projects.[13] These funds are specifically designated for energy efficiency improvements.

Senate Bill 734 (Session Law 2014-120, Section 55) revised the requirement that state-owned facilities provide updates regarding their utility usage and costs, as well as the implementation of management plans from an annual to a biennial-basis.

In October 2018, Governor Cooper's EO80 (Section 8) built on the statutory requirements in GS §143-64.12(a) by directing cabinet agencies to collectively strive to reduce energy consumption per square foot by at least 40% of fiscal year 2002-03 levels by 2025. The EO required that the DEQ's USI program update the Comprehensive Program with strategies to assist state-owned buildings in reducing energy consumption to meet the EO80 goal. In addition, the USI program was tasked with encouraging and assisting, upon request, the UNC System, K-12 schools, and local governments in reducing energy consumption. To meet the EO80 goals, the EO required that cabinet agencies designate an *"Agency Energy Manager"*, prepare a biennial *"Agency Utility Management Plan"*, submit utility data and progress towards the EO80 goal, and required the USI program to provide an annual progress report to the Governor's Office.

3.1 Roles and Responsibilities of Key Entities

Table 3 provides a breakdown of responsibilities that entities involved with the Comprehensive Program are required to perform with reference to the corresponding legislation or executive order.

[13] It should be noted that SEO found historical data entry and formula errors in the official "carry forward" submittal to OSBM for North Carolina Central University [$15,915 improper credit], UNC Chapel Hill [$103,270 improper exclusion], and UNC Pembroke [$70,970 improper credit] that impacts the total claimed savings specified in this report. In addition, there was a separate data entry error for the "cost of new projects" for East Carolina University [$800 overage] and North Carolina State University [$2.28MM overage] that collectively overestimated data for the category. The values in this report reflect the most accurate tabulation of the "savings claimed" and "cost of new projects" for FY2021-22 based on datasets provided by participating UNC System schools.

Table 4: Roles and Responsibilities of Key Entities

Basis	Responsibility	Reference	Assigned Entity
EO80	Encourage and assist, as requested, higher education institutions, K-12 schools, and local governments in reducing energy consumption per square foot in state-owned buildings by at least 40% from FY 2002-03 levels by 2025.	EO80 Section 1(c) and 8	Cabinet Agencies; DEQ USI
	Designate an Agency Energy Manager that serves as an agency's primary point of contact.	EO80 Section 8(a)	Cabinet Agencies
	Implement strategies to support the energy consumption goal in EO80 and submit an Agency Utility Management Plan to the DEQ's USI program by March 1st of every odd-numbered year. The plan should describe the proposed strategies to reduce energy consumption per square foot in state-owned buildings by at least 40% from FY 2002-03 levels by 2025.	EO80 Section 8(b)	Cabinet Agencies
	Submit an Agency Utility Report to the DEQ's USI program by September 1st of each year. The report should contain the consumption, costs, and progress achieved towards meeting the statutory and EO80 directives.	EO80 Section 8(c)	Cabinet Agencies
	Assess the adequacy of agency Utility Management Plans and their compliance with EO80. Develop annual report describing the Comprehensive Program and summarize each cabinet agency's utility consumption, costs, and achieved reductions, completed by December 1st.	EO80 Section 8(b) and 8(d)	DEQ USI
	Develop and annually-update a Comprehensive Program to manage energy, water, and other utilities for state agencies and institutions of higher learning.	GS §143-64.12(a)	DEQ USI
	Submit a utility management plan consistent with the DEQ USI Comprehensive Program biennially. The plan should address findings or recommendations from the Department of Administration energy audits. In addition, the plan should include supporting strategies to reduce energy per gross square foot by at least 30% from FY 2002-03 levels by 2015.	GS §143-64.12(a) and (b1)	All state Agencies; UNC System
	Submit a biennial written report of utility consumption and costs.	GS §143-64.12(a)	Community Colleges
	Carry out the construction and renovation of facilities to further the energy conservation measures and ensure the use life-cycle cost analyses.	GS §143-64.12(a1)	All state Agencies; UNC System

Basis	Responsibility	Reference	Assigned Entity
GS	Create and implement the policies, procedures, and standards to ensure that state purchasing practices improve efficiency regarding energy, water, and utility usage. The cost of such products should be considered regarding their economic life. Administer the Building Energy Design Guidelines that include energy-use goals and standards, economic assumptions for life-cycle analysis, and other criteria on building systems and technologies. Modify the design criteria for constructing and renovating state buildings and the UNC System to require that a life-cycle cost analysis be conducted in accordance with GS §143-64.15.	GS §143-64.12(b); and GS §143-64.15	DOA
	Identify and recommend low-cost energy conservation maintenance and operating procedures that reduce energy consumption within state-owned buildings as part of the Facility Condition Assessment Program (FCAP). Consult with the DEQ USI program to develop an energy audit and procedure for conducting such audits. Conduct an energy audit for all state agencies and the UNC System every five years. The energy audit should serve as a preliminary energy survey.	GS §143-64.12(b1)	DOA
	Implement recommendations from Department of Administration and maximize the interchangeability and compatibility of energy management equipment components.	GS §143-64.12(b1)	All state Agencies; UNC System
	Conduct detailed system-level energy surveys every five years.	GS §143-64.12(b1)	DEQ USI
	Submit a report of the energy audit required in accordance with GS §143-64.12(b1) to the affected state agency or the UNC System.	GS §143-64.12(b1); and GS §143-64.12(b2)	DOA
	Review each energy audit conducted by the Department of Administration and consult with the affected state agency or the UNC System to incorporate the findings into the management plan required by GS §143-64.12(a).	GS §143-64.12(a); and GS §143-64.12(b2)	DEQ USI
GS	Identify and recommend facilities of state-agencies or the UNC System that are suitable for either: (1) building commissioning to reduce energy consumption; or (2) guaranteed energy savings contracts pursuant to GS §143-64.17.	GS §143-64.12(h); and GS §143-64.17.	DOA

Basis	Responsibility	Reference	Assigned Entity
	Develop a biennial report on the Comprehensive Program to the Joint Legislative Energy Policy Commission; the Oversight Committee on Agriculture and Natural and Economic Resources; and the Fiscal Research Division by December 1st of odd-numbered years. The report should contain the elements set forth in GS §143-64.12(j)(1) through (j)(5)	GS §143-64.12(j)	DEQ USI

4.0 Reporting Requirements

4.1 Comprehensive Program and Executive Order No. 80 Update

GS §143-64.12(a): *"The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for state agencies and state institutions of higher learning and shall update this program annually"*

While GS §143-64.12(a) requires state agencies and the UNC System collectively to meet the goal of a 30% reduction in Btu's per square foot by 2015, some participants have not been able to individually reach the objective. USI will continue to assist them in reaching this goal. Additionally, EO80 established a new objective for state-owned buildings of a -40% EUI by 2025 from a 2002-03 baseline. Each cabinet agency is required to appoint an Energy Manager to oversee the collection and reporting of utility data and development and implementation of the agency utility management plan in accordance with GS §143-64.12(a) and EO80, Section 8. The plans should include robust strategies that support statutory requirements and executive initiatives to reduce energy consumption in state-owned buildings.

The USI program prepares an annual update to Governor Cooper that tracks annual utility consumption and progress towards EUI reduction goals of the affected reporting entities under EO80. USI performs individual site visits to detail best practices and works to maintain savings already achieved by governmental units. Obtaining the mandated EUI reduction objectives will help improve the value of the State's infrastructure, increase the cumulative avoided utility costs, and reduce environmental pollution associated with fuel and electrical consumption.

Below are three primary focus areas of the Comprehensive Program managed by the USI:

Best Practices & Training

Site visits by the USI team remain the cornerstone of support to local and state government facility managers. USI provides preliminary energy audits, project evaluations, and implementation strategy assistance. USI also reviews utility bills and encourages participants to engage in current programs to reduce energy consumption. A core component of the USI program provides relevant energy efficiency training to local and state government facility managers. Historically, this training includes the Energy Management Diploma series (through North Carolina State University's Office of Professional Development), the creation of a utility management plan, analyses of utility bills, and conducting classes on building systems and programs to increase efficiency. USI encourages engagement of community user groups and stakeholders along with fostering dialogue and sharing of best practices across governmental units.

Cost Estimates & Financial Options

USI assists state and local government building owners with developing cost estimates and prioritizing energy saving projects. Once project scopes are established, USI can then assist with recommending various types of funding mechanisms based on the situation. These often include equipment rebates, federal or state grants, tax incentives, Guaranteed Energy Savings Contracts (GESCs), and an assortment of utility provider programs. In addition, USI can review project proposals to ensure they best fit the needs of governmental units. On a more granular level, USI will review utility bills to look for saving opportunities such as rate classification changes or peak shaving. USI continuously seeks additional resources to expand energy efficiency programs within state and local government buildings.

Reporting Requirements

The USI team updates and submits reports on the Comprehensive Program, EO80 Section 8, GESCs, HB1292 credits, and utility management plans to stakeholders to provide a status update of key successes.

4.2 Overview of Utility Use and Efficiency Gains for State-Owned Buildings

EO80 Section 8: "*DEQ shall develop an annual report that describes the Comprehensive Program and summarizes each cabinet agency's utility consumption, utility costs, and achieved reductions in energy consumption. DEQ shall complete this report for publication on its website and for the Council to submit to the Governor by February 1, 2019, and annually thereafter beginning December 1, 2019.*"

The following tables provide a collective summary of energy and water reduction progress for the UNC system, state agencies, and community colleges. Agency-specific data is provided in Appendix A.

Table 5: State Agency and State Institutions of Higher Learning Efficiency Gains

Participant		Cabinet Agencies	Other Agencies[1]	UNC System[2]	State Governmental Units Combined Total
Gross Square Footage	Baseline 2002-03 (Mgsf)	34	4	57	95
	Current 2020-21 (Mgsf)	42	5	93	141
	% Change	+24%	+40%	+63%	+48%
EUI	Baseline 2002-03 (Btu/gsf)	128,615	52,089	168,835	149,509
	Current 2020-21 (Btu/gsf)	88,247	43,765	110,173	100,950
	% Change	-31%	-16%	-35%	-32%
Water	Baseline 2002-03 (gal/gsf)	63	20	49	53
	Current 2020-21 (gal/gsf)	49	12	21	30
	% Change	-22%	-42%	-56%	-44%

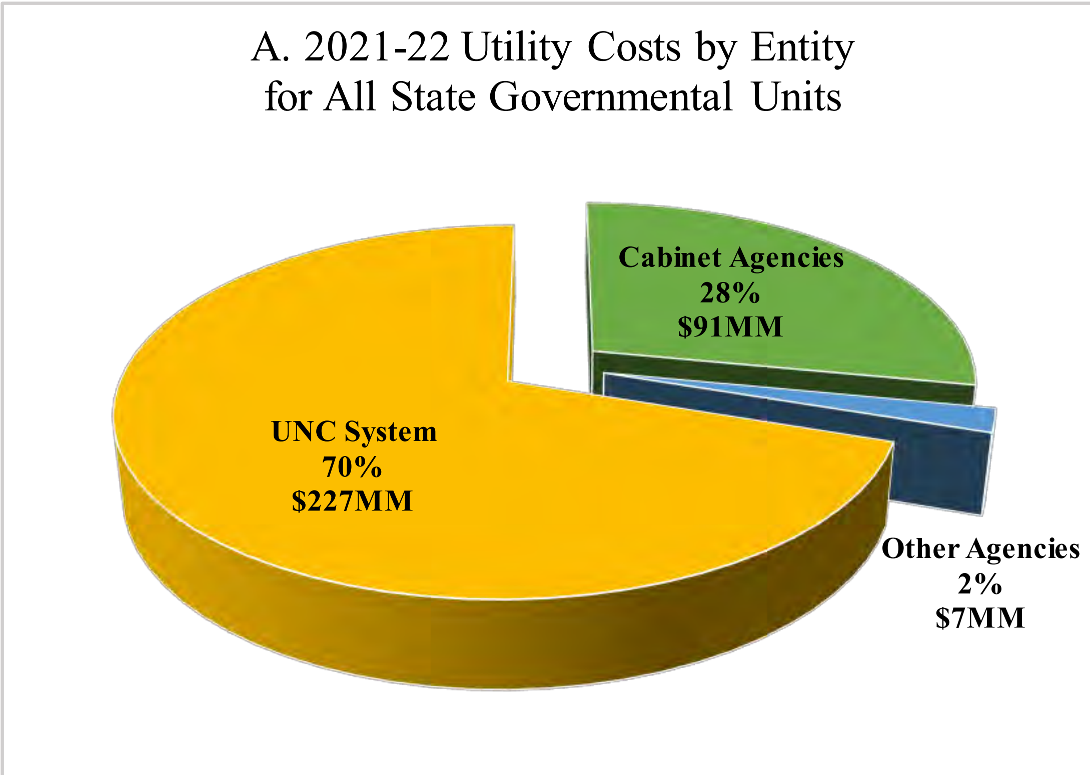
[1]The main WRC campus was not built until 2005-06, and thus, is not included in baseline (FY03)

[2]UNC School of the Arts data was not reported prior to FY2005-06 and was assumed to be constant for all fiscal years prior

Energy Consumption and Savings Highlights from Table 4.

- EUI (Btu/gsf)
  - The Cabinet Agencies are at a 31% reduction from baseline
  - Other Agencies are at a 16% reduction
  - UNC System is at a 35% reduction
  - Total combined state-owned buildings are at a 32% reduction

- Change in Square Footage and Water Usage
  - Total combined state-owned building area has increased by 48% compared to baseline
  - Total combined water usage has decreased by 44% from the baseline



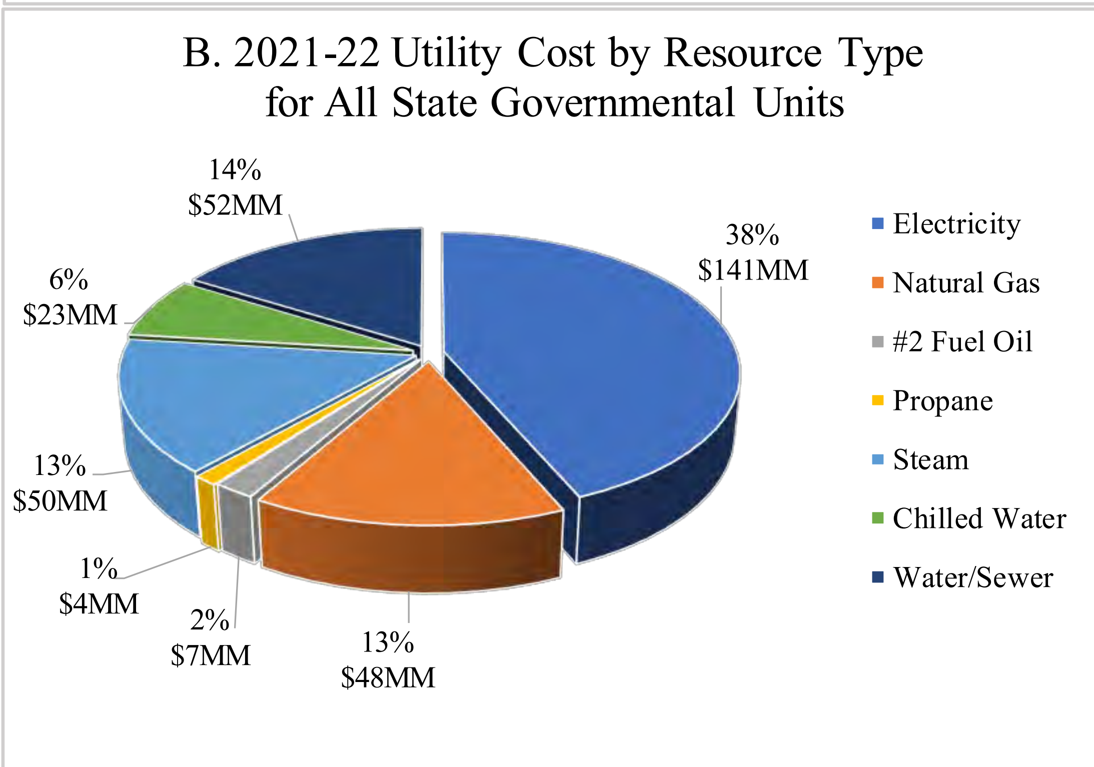


Figure 2: Total Utility Cost for All State Governmental Units ($325MM) by (A) Entity and (B) Resource Type.

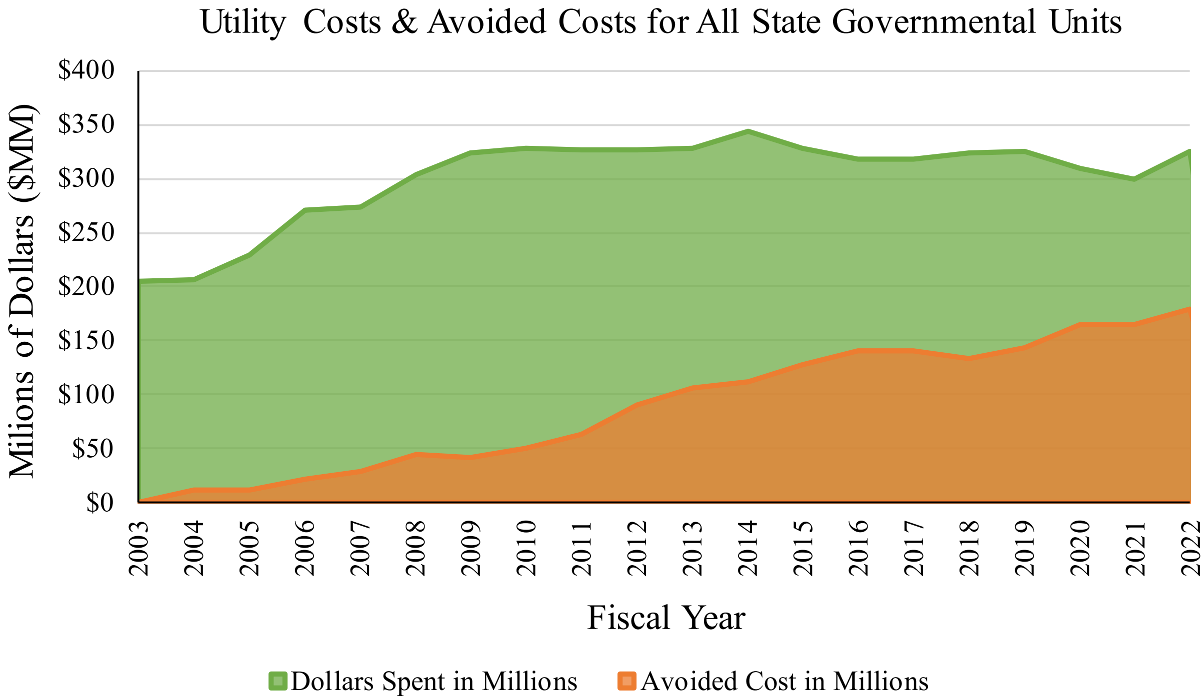


Figure 3: Avoided Utility Cost for All State Governmental Units

Utility Cost Highlights *(See Table 2 in the Executive Summary Section)*

- Avoided Utility Cost
  - Approximately $177 million in avoided utility costs in FY2021-22.
  - Approximately $1.75 billion avoided in utility costs since FY2002-03.

- Expenditures
  - Approximately $325 million in total utility costs (electricity, fuels, and water) for FY2021-22 (this includes all agencies and the UNC system). Over two thirds of this amount is paid by the UNC System.

UNC System

In FY2011-12, a discussion started at Appalachian State to put together an Energy Summit for UNC System members to talk about EUI reduction and sustainability. With the UNC System Office on board, this started a system wide initiative with the objectives to educate students to be leaders of tomorrow, reduce and stabilize the UNC System energy expenditures, transform North Carolina's economy, position colleagues to be national leaders, and to create a culture of environmental and economic sustainability.

The UNC System and its affiliates continue to work hard to be at the forefront when the State Energy Office talks about success in energy efficiency. With the encouragement of EO80, the UNC System has pursued the challenge to reduce their EUI by 40% of FY2002-03 levels by 2025. This goal was already being discussed and some of the UNC System were pushing towards this goal without EO80. This year's 2021-22 annual consumption reports for the UNC System shows that they are closest to independently achieving the 40% reduction goal by 2025. Overall, the UNC System achieved over $1.43 billion in avoided costs between 2002-03 to 2021-22. The leading universities have energy management teams that consistently reinvest in efficiency projects. By the UNC System continuing to make energy improvements and building efficient buildings, they can typically handle events that cause utility bills to fluctuate such as rapidly returning to in-person operations. Their EUI slightly increased by one percentage point this FY (i.e., moving from -36% in 2021 to -35% in 2022); however, their facilities were also concurrently increasing occupancy, square footage, hours of operation, and indoor health/safety measures to combat communicable diseases. While the EUI increase is not ideal, their energy stewardship has assisted with preventing significant and cascading impacts to the state's collective utility consumption and cost data used to derive the EO80 status report.

Through the Summit, the UNC System has emphasized that knowledge sharing is crucial for energy management success. They have worked to break down communication "silos" to guide others to become more efficient. USI continues to use the UNC System as the model for energy efficiency. When asked, the UNC System is always ready to educate and assist other entities and sectors.

Table 6 shows the UNC System summary. Square footage has increased by 63% while utility costs have increased by 68%. The UNC System had a 35% EUI reduction this fiscal year. Also, water usage has decreased by 56%, which is significant considering water costs have increased by 207% over the same timeframe.

Table 6: UNC System Utility Assessment

Metric	Fiscal Year		% Change
	2002-03[1]	2021-22	
Total Gross Square Feet	56,806,527	92,553,860	+63%
Total Utility Cost	$135,311,298	$226,774,443	+68%
Energy Usage (Btu/gsf)	168,835	110,173	-35%
Energy Cost ($/MMBtu)	$13.00	$19.97	+54%
Water Usage (gal/gsf)	49	21	-56%
Water Cost ($/kgal)	$3.80	$11.65	+207%

[1]UNC School of the Arts data was not reported prior to FY06 and was assumed to be constant for all fiscal years prior

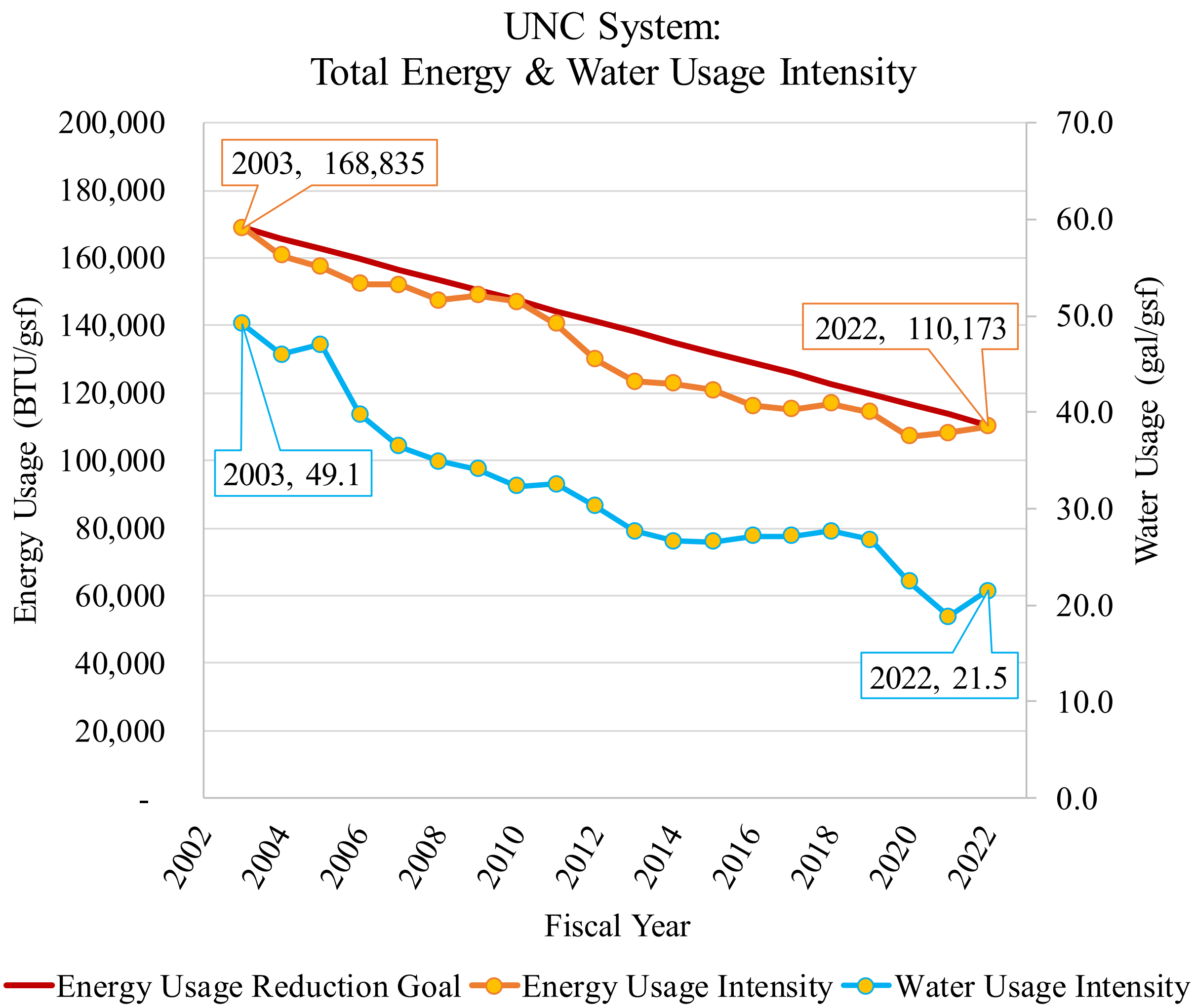


Figure 4: UNC System Utility Usage Over Time

<u>Cabinet Agencies</u>

As required by January 15, 2019, all the cabinet agencies have appointed an energy manager to oversee the agency efforts in achieving the EO80 goal. DPS was the only agency that already had a dedicated energy manager; however, all other newly designated energy managers continue to have other full-time jobs/responsibilities that distract from energy management. With the total dollar amount that most state agencies spend on utilities, the lack of a full-time commitment or dedicated energy management staff have proven to be a factor in agencies not moving toward the established reduction goals more quickly. This is emphasized by the utility spending of state cabinet agencies, which was approximately $91 million dollars this year; more effective energy management could reduce this spending. DPS, DHHS, DOT, DOA, and DNCR are the five largest agencies in the consumption of utilities making up 98% of the cabinet agency expenditures for FY2021-22.

Many of the agencies could benefit from pursuing Guaranteed Energy Saving Contracts (GESC) to quickly implement the necessary energy conservation measures. There are currently 20 projects within state governmental units. In addition, DPS and DNCR are actively working on contractual documents to begin additional GESC projects that will significantly reduce energy consumption and costs for facilities such as prisons, aquariums, museums, and the NC Zoo.

Discounted for many years is the substantial amount of deferred maintenance, outdated equipment, antiquated technology, aging infrastructure, limited staff and most importantly, the financial resources required to make major comprehensive energy improvements. Many cabinet agencies provided funding requests to address some of these energy related needs, but more resources must be allocated to address the many years of neglect if they are to reach the EO80 goal. Cabinet agencies are investing limited resources, as available, to move to LED lighting, provide staff education, and to identify additional low- and no-cost energy conservation measures. The State Energy Office along with the cabinet agency energy managers are working together on this effort.

Table 7 shows the cabinet agency summary. Square footage has increased by 24% while utility costs have increased by 33%. The EUI usage for all cabinet agencies has a 31% decrease since baseline. Water usage has decreased by 22% while water costs have increased by 124%. More detailed information about individual agencies may be found in Appendix A.

Table 7: Cabinet Agencies Utility Assessment

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	34,297,758	42,457,192	+24%
Total Utility Cost	$68,529,275	$91,100,874	+33%
Energy Usage (Btu/gsf)	128,615	88,247	-31%
Energy Cost ($/MMBtu)	$12.59	$16.82	+34%
Water Usage (gal/gsf)	63	49	-22%
Water Cost ($/kgal)	$5.98	$13.40	+124%

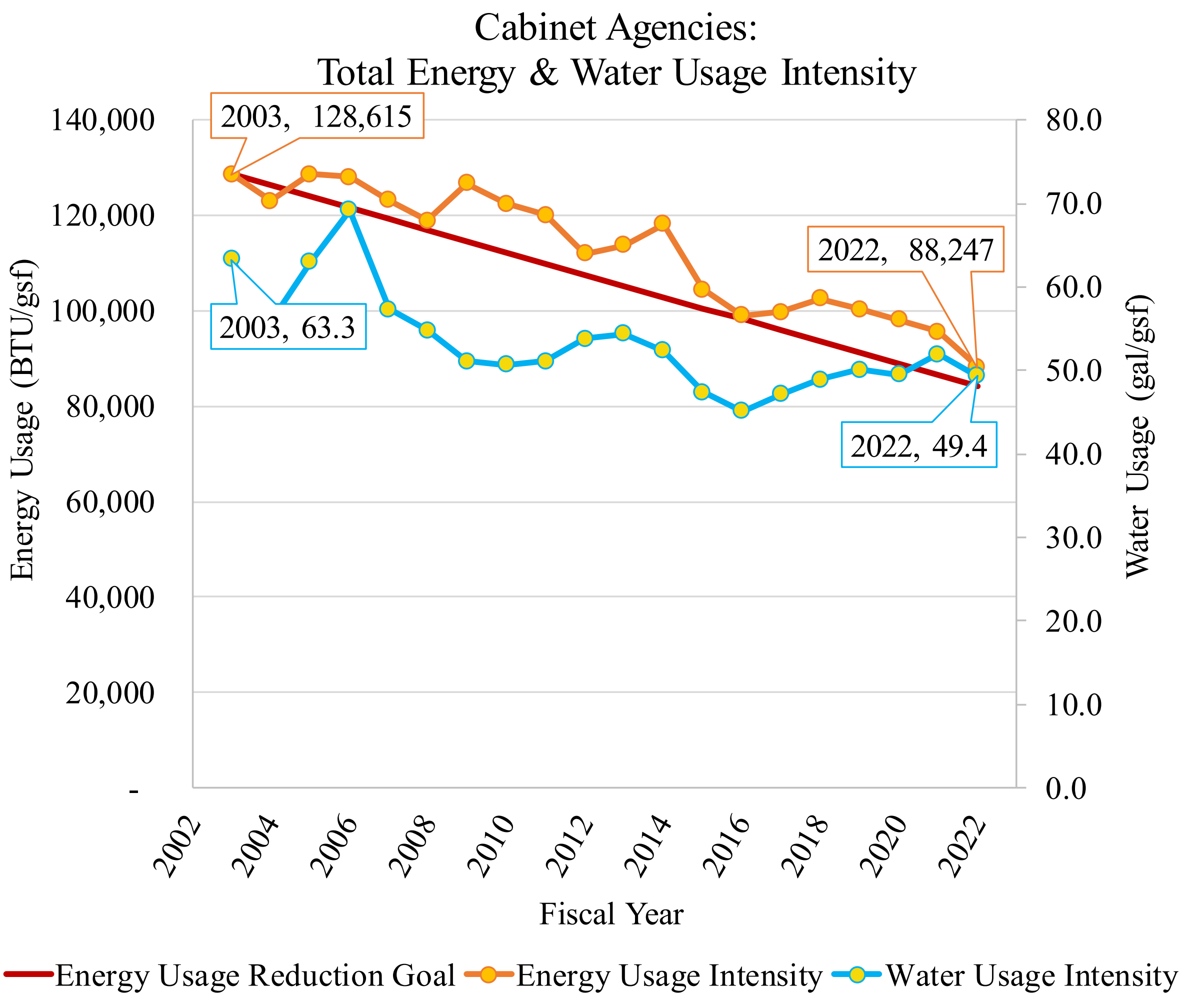


Figure 5: Cabinet Agency Utility Usage Over Time

<u>Other Agencies</u>

While EO80 applies directly to the cabinet agencies, other state agencies are strongly encouraged to adopt the same -40% EUI goal from FY2002-03 levels. Such agencies include the Department of Agriculture and Consumer Services, the Department of Justice, the Department of Public Instruction, and the Division of Wildlife Resources. Although these agencies were not required under EO80 to appoint an energy manager, they would benefit from hiring dedicated energy managers and energy policies. This would be a decisive step towards improving their current 16% reduction in EUI from the baseline. More conservation and efficiency efforts from these agencies would contribute towards the collective state-owned building energy reduction calculation and help with achieving the EO80 goal.

Table 8 shows the summary for these other state agencies. Square footage has increased by 40% while utility costs have increased by 97%. The EUI for all "other" agencies has reduced 16%. Water usage has decreased by 42% while water costs have increased by 245%.

Table 8: Other Agencies Utility Assessment

Metric	Fiscal Year		% Change
	2002-03[1]	2021-22	
Total Gross Square Feet	3,912,815	5,495,920	+40%
Total Utility Cost	$3,391,431	$6,692,133	+97%
Energy Usage (Btu/gsf)	52,089	43,765	-16%
Energy Cost ($/MMBtu)	$14.75	$23.34	+58%
Water Usage (gal/gsf)	20	12	-42%
Water Cost ($/kgal)	$4.82	$16.61	+245%

[1]WRC campus was not built until 2005-06 is not included in baseline (FY03)

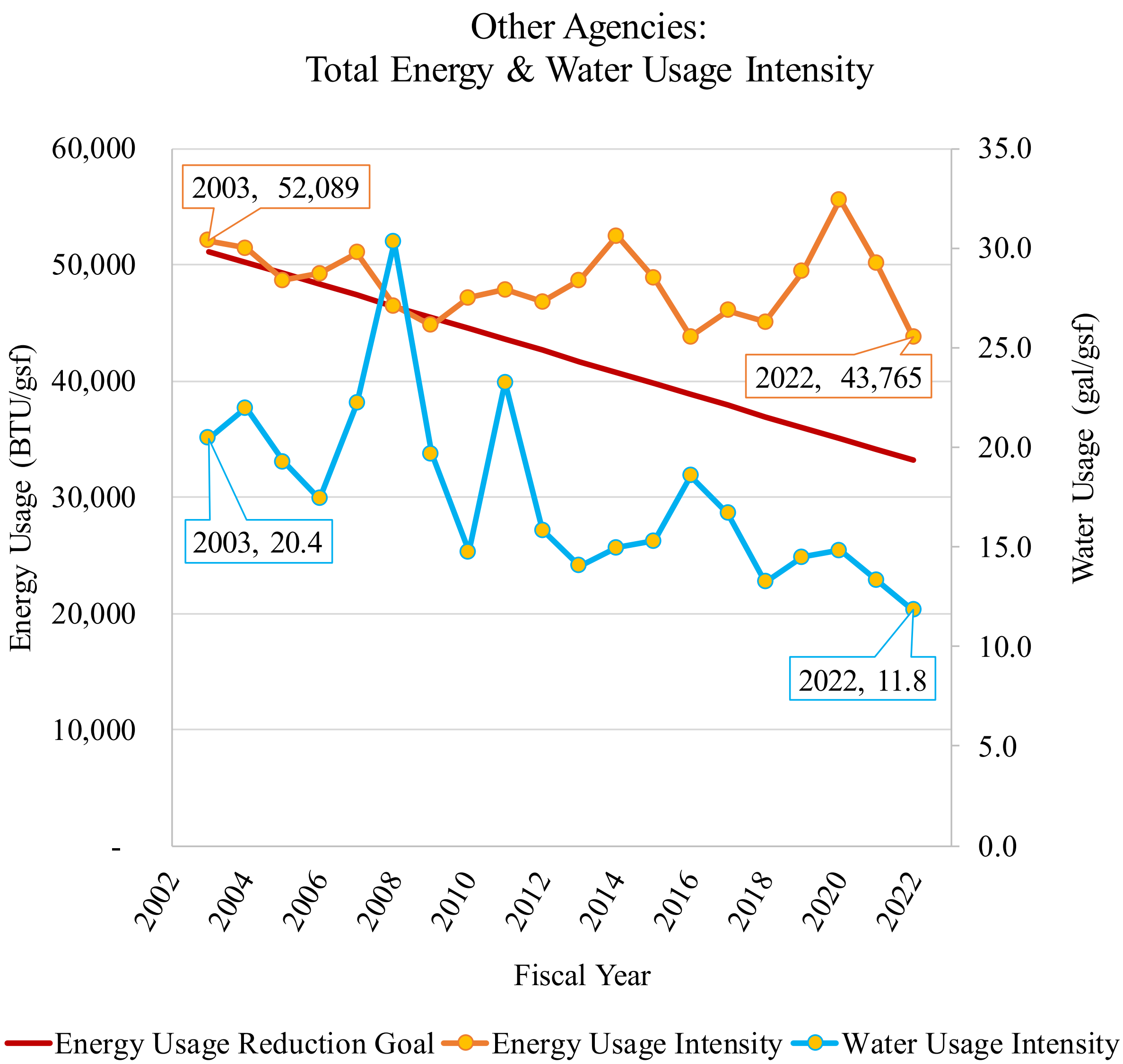


Figure 6: Other Agency Utility Usage Over Time

4.3 Summary of Utility Management Plans

EO80, Section 8(b): *"Each cabinet agency shall develop and submit an Agency Utility Management Plan to DEQ by March 1, 2019, and biennially thereafter, and implement strategies to support the energy consumption reduction goal set forth in Section 1 of this Executive Order. DEQ shall assess the adequacy of these plans and their compliance with this Executive Order."*

According to the United States Department of Energy, utility management plans are intended to clearly articulate goals that reduce waste, support environmental stewardship, and provide monetary savings to taxpayers.[14] Utility management plans are a necessary tool in helping governmental units achieve energy reductions. Significant planning and effort must be invested long before energy conservation measures can be realized. Projects require ownership, coordination, approvals, and funding. In order to achieve the EO80 goal by 2025, state governmental units should have already provided a defined path and plan. However, many of the utility management plans received varied in quality. Some provide minimal guidance as to how the state governmental units intend to meet the energy efficiency goals while others lack clear strategies, objectives, or identification of funding resources to be allocated by the state governmental units. Several plans do not specify dates, responsibilities, or assignments for specific individuals/departments to ensure that the tasks are completed, and energy efficiency is achieved. Without forecasting how energy dollars are to be allocated to efficiency projects, limited funding resources often are not aligned with energy goals. Furthermore, these plans are often not the collaboration of an interagency group, but the work of specific individuals. Without broader input, the plan becomes narrowly focused and frequently results in increased facilities maintenance workload. Leadership endorsement and participation is required for the plans to be successful. Acknowledgement and support of energy priorities must be communicated to the whole organization. Without all these elements, the plans often fail to achieve stated goals.

Therefore, USI has developed a list of best practices for utility management plans. A well-written plan should contain the following items:

1. Utility Reports with consumption and costs, and efficiency gains
2. Specific projects, strategies and responsibilities for achieving the goals
3. Assignment and authority of overall energy management success
4. Training of staff to communicate plan objectives
5. Financing options for funding energy savings projects
6. Signature page that shows upper management acknowledgement

Table 9 and 10 *(on the next two pages)* summarize the governmental units that did and did not submit utility management plans for inclusion in this report. For reference, utility management plans submitted on or after March 1, 2021 for EO80 Section 8 are reflected in Table 9. In addition, plans submitted by UNC constituent institutions in pursuit of "carry forward" savings for FY2021-22 under NCGS 116-30.3B are reflected in Table 10.

[14] https://www.energy.gov/sites/prod/files/2014/05/f15/cesp_guide.pdf

Table 9: Utility Management Plans Submitted for EO80 by March 2021

Cabinet Agencies	**Plan Submitted?**	
	Yes	**No**
Department of Administration	X	
Department of Commerce	X	
Department of Environmental Quality	X	
Department of Health and Human Services	X	
Department of Information Technology	X	
Department of Military and Veterans Affairs[1]	X	
Department of Natural and Cultural Resources	X	
Department of Public Safety	X	
Department of Revenue[2]	X	
Department of Transportation	X	
Council of State Agencies		
Department of Agriculture and Customer Services	X	
Department of Justice		X
Department of Public Instruction		X
North Carolina Wildlife Resources Commission	X	

[1]Military and Veterans Affairs federal buildings previously excluded from State plan requirement.

[2]Revenue is a DOA tenant agency (utilities paid by DOA)

Table 10: Utility Management Plans Submitted for NCGS 116-30.3B Carry Forward savings

University of North Carolina System	Plan Submitted?	
	Yes	No
Appalachian State University	X	
East Carolina University	X	
Elizabeth City State University		X
Fayetteville State University	X	
North Carolina A&T University		X
North Carolina Central University		X
North Carolina School of Science and Mathematics	X	
North Carolina State University	X	
The North Carolina Arboretum	X	
University of North Carolina Asheville		X
University of North Carolina Chapel Hill	X	
University of North Carolina Charlotte	X	
University of North Carolina Greensboro	X	
University of North Carolina Hospitals	X	
University of North Carolina Pembroke		X
University of North Carolina School of the Arts	X	
University of North Carolina System Office		X
University of North Carolina TV		X
University of North Carolina Wilmington	X	
Western Carolina University	X	
Winston-Salem State University	X	

In the utility management plans submitting, the following energy conservation measures were most frequently mentioned as being implemented:

Light Emitting Diode (LED) Lighting: LED lighting technology is growing exponentially while costs have decreased. LED area lighting improves safety, dramatically reduces maintenance requirements/costs and has a high return on investment. Maintenance staff are embracing LED lighting because this technology significantly reduces maintenance requirements. For example, such fixtures may require little to no maintenance over a period of 10 to 20 years.

Building Automation System (BAS): BAS improvements or installation continues to be needed in most facilities. Building automation is the centralized control of a building's HVAC, lighting, and other systems. This control is achieved through a building management system (BMS) or a BAS. The purpose of building automation is to improve occupant comfort, to improve the efficiency of building systems, to identify maintenance issues and to reduce energy consumption and operating costs. A centralized system also takes the control out of the hands of multiple occupants, which provides improved energy savings and helps prevent 24/7 operation by allowing both occupied and unoccupied set points.

Equipment Replacement: Energy consuming equipment replacement as related to HVAC (e.g., variable air volume boxes), chillers, and water heating (i.e., boilers) is increasing, primarily driven by the age of the equipment. Most facilities have been diligent in trying to maintain existing equipment, but as staff resources dwindle, this only reduces the life expectancy of this energy consuming equipment. Many facilities need extensive amounts of new equipment and improvements to aging infrastructure that supports this machinery. Equipment replacement can be easier to implement, yet costly, for institutions with central steam plants on campus.

Submetering: Metering and the increased ability to measure energy usage of buildings is needed. Energy metering and environmental monitoring provide valuable information regarding how buildings are performing. While this energy conservation measure does not technically provide energy savings, energy metering can help identify cost-cutting opportunities by detecting inefficiencies. Submetering is required to be able to benchmark each building and to help identify buildings that are out of line and where excessive energy usage needs to be addressed. Submetering with new sensors that monitor indoor temperature and humidity can help building operators track indoor air quality.

Employee Engagement: Energy awareness across campuses continues to be highlighted in almost all plans. Energy awareness helps define the governmental unit's energy mission and goals by establishing a direct relationship between saving energy and success in meeting these goals, all while assessing the constraints and opportunities within a facility. Evaluation of energy use patterns based on the types of equipment, size of staff, hours of operation, and current levels of energy use ensure obtainable goals are delivered and determine activities well-suited to the organization's planned needs. Upper management support endorses the program's messages while energy awareness uses various communications channels and program capability to produce printed materials, displays, videos, and handouts to drive this awareness.

Governmental units are contending with competing priorities and other primary responsibilities along with limited resources and staff to identify energy efficiency projects. Requests were made to expand financial resources so that identified energy projects can be performed. Prioritization and reinforcements are needed from within the governmental unit and the governor's office for the EO80 goal to be achieved. The mission of each governmental unit is critical, and what has been discounted for years is the substantial amount of deferred maintenance, outdated equipment, antiquated technology, aging infrastructure, limited staff and most importantly, the financial resources required to make major comprehensive energy improvements. The State Energy Office, along with the governmental unit energy managers, are working together on this effort. Energy savings must be elevated in importance within each governmental unit's daily responsibilities.

5.0 Recommendations for State Governmental Units to Reduce Energy Consumption

In addition to achieving continued reductions in existing buildings' energy and water use, new buildings must be constructed to energy efficiency standards. As new buildings are constructed, governmental units have greater ability to operate and to monitor building performance thereby ensuring energy efficiency goals are met. Sectors that have aging buildings and infrastructure continue to experience difficulties in optimizing building operations and with monitoring energy usage. Transitioning from old, out of date technology to new technology and systems better enables buildings to meet energy goals. These improvements will also improve building comfort and indoor air quality. USI continues to recognize achievements and promotes best practices through programmatic and legislative means. The following are key areas to be addressed.

5.1 Energy Program Management

Offset Competing Energy Priorities

Electrification of space heating and transportation poses new load growth challenges for building energy use. As the adoption of electric vehicle increases in North Carolina, the charging infrastructure at the building level would cause the energy use of buildings to increase. This increase poses new challenges since while the load growth adds energy use (thereby increasing the EUI of the buildings), the load increase is more efficient and environmentally benign compared to gasoline-powered vehicles. Similarly with space heating, the high energy efficiency of heat pumps is beneficial, while adding new demand on the buildings. Demand-side management measures can be especially beneficial in this context. A recent report by the Department of Energy[15] found that buildings (which accounted for 35% of U.S. carbon dioxide emissions in 2021 and 39% of total U.S. energy consumption) can save $100-200 billion in power system costs by incorporating demand-side management measures like energy efficiency and demand response.

Technologies like rooftop solar paired with on-site energy storage can also offset some of this additional load increase and improve the overall energy efficiency of the building. The Department of Energy's Solar Energy Technologies Office provides guidance for local governments[16] to boost solar deployment by identifying key barriers and guidance on engaging in a robust stakeholder process. Other states have partnered with utilities to deploy solar on public buildings. For example, Consumers Energy and Michigan made a partnership in 2022 to deploy rooftop solar arrays on 1,274 public buildings, aiming to install 68 MW of solar capacity through the process.[17] Such efforts in North Carolina can bolster the ability to achieve the goals set forth by HB-951 while complementing the efforts of the USI.

The 2018 Commercial Buildings Energy Consumption Survey conducted by the Energy Information Administration provides new insights on how energy use in office buildings has changed from 2012 to 2018.[18] The survey is the only independent, statistically representative source of national-level data on the characteristics and energy use of commercial buildings. The preliminary results released this year showed that energy use in office buildings had statistically significant decrease in total energy from 2012 to 2018, with electricity and natural gas accounting for 94% of total energy consumption. The South census region, which includes North Carolina, had the largest share of electricity usage than any other region (2357 trillion Btu with 69% consumed by electricity). In 2018, the study found that commercial buildings spent, $1.47 per square foot, on average. Electricity use intensity was higher in hotter climates, but the impact of widespread space heating electrification remains to be seen.

[15] https://gebroadmap.lbl.gov/
[16] https://www.energy.gov/eere/solar/local-government-guide-solar-deployment
[17] https://pv-magazine-usa.com/2022/08/11/michigan-pledges-to-cover-over-1200-public-buildings-with-solar/
[18] https://www.eia.gov/consumption/commercial/

Dedicated Energy Manager

Every successful energy program must have a champion. That is a person who is fully committed to and consistently works to further the program goals. An energy manager serves this role, and the importance cannot be overstated. A full-time, dedicated energy manager is an important asset and can recover energy savings and costs that exceed their salary multiple times. As such, USI has advocated for several years that every agency, university, and community college hire at least one full-time, dedicated energy manger. The UNC system has adopted this philosophy as evidenced by the fact that most UNC system universities currently employ at least one full-time energy manager, and several have whole dedicated energy management teams. As a result, the UNC system leads all public sectors in reducing their energy consumption from baseline levels. The UNC EUI is currently at -35% which exceeds cabinet agencies by -4% and other agencies by -19%. Governor Cooper also recognized the importance of energy managers and directed through EO80 that all cabinet agencies appoint energy managers. While energy managers are needed, most state agencies complied by appointing an existing employee who already had another full-time position. Energy management was added as an additional duty on top of the employee's existing workload. Without being able to dedicate full-time efforts, these employees are not able to be as effective nor achieve the energy efficiency results a full-time energy manager could. DPS is the only state agency who currently has full-time, dedicated energy managers. Alternatively, DHHS aims to hire a full-time energy manager as soon as funds are secured for the position. The remaining agencies will hopefully follow their leadership and find funding mechanisms for the positions.

Once a full-time energy manager is hired, other factors must also be considered in order to help this position succeed. First, leadership must prioritize the need for energy efficiency goals to be met within the organization. When upper management prioritizes and supports the importance of energy conservation, the rest of the organization will respond accordingly. This sets the tone and expectation for everyone to participate. Second, the energy manager must be positioned strategically within the organization. They are typically located within a facilities department but have close ties to the business office. That is because they need to know about the equipment and building projects being planned but also be aware of budgets and utility spending. Every project from a stand-alone HVAC package unit to new building construction should be reviewed by the energy manager. Third, they should have the authority to influence and direct these projects for the selection of energy efficient equipment and other energy conservation design considerations. This involvement helps to ensure that a complete life cycle cost is weighed against the upfront costs. Often equipment which might be the cheapest to purchase will cost more in operation over the long run. Fourth, the energy manager should have a dedicated source of funding to implement conservation measures. Ideally, documented savings from energy efficiency measures can be tracked and those funds returned so that additional measures can be implemented. In this manner, the overall savings begins to grow and cascades as an organization becomes more efficient. That is a key indicator of a successful energy management program.

Utility Data Collection

Once an energy manager is hired, utility data is an essential part of their energy management program. Utility data is the key to determining which buildings are the highest energy users, which utilities cost the most, where conservation efforts should be focused, have savings been achieved, and whether are leaks occurring. Without data providing measurements of utility usage, an energy manager is working without guidance and cannot properly manage the energy usage of an organization. However, some organizations receive thousands of utility bills from a multitude of providers every month. Merely collecting and compiling all these bills into a usable format can be an arduous task that subtracts from the goal and active work of managing energy. That's why several organizations have turned to third party data collection services to manage and to provide data from all their utility bills. This third party collects, verifies, reconciles, and records all bills so that the energy manager can access the data with ease. Formatted reports are available with up-to-date information so that energy managers can track utility usage from month to month and analyze fluctuations which can signal potential issues. This type of regular and consistent analysis is imperative to understanding and managing the utility consumption for an organization.

Recommended "Minimum Best Practices" for Stewardship of State-Owned Buildings

As 2025 approaches, USI created a list of five "minimum best practices" that should be implemented to maximize economic and environmental stewardship of state-owned buildings. These core principals are necessary to further progress towards the EO80 -40% EUI goal.

1. LED Lights

Light Emitting Diode (LED) is now the standard to which all lighting is compared. LEDs are made from non-toxic materials and can last from ten to fifteen years (which is around six times the life of regular bulbs). The price of LED has decreased significantly since they were first introduced while the cost for non-LED lighting increases as those technologies are being phased out. As such, LEDs not only reduce energy but are also now cost efficient. Moreover, studies continue show that lighting style, such as cooler colors, can increase office productivity.[19] LED's offer a variety of lighting options that are both controllable in the office environment and energy efficient.

2. BAS or Programmable Thermostats with Setbacks

Having the ability to control when and how the HVAC is operated will allow for better system operation and energy savings. These controls provide the ability to set systems back at night and weekends or during times that the facility is unoccupied. Most programmable thermostats have security settings that will lock the setting to prevent tampering. This allows for improved energy savings and control of operation when the building is occupied and when unoccupied.

3. HVAC and Water Heating System Condition

While it may not be economical to purchase new HVAC and water heating systems in all buildings, there should be a uniform requirement that existing equipment be recommissioned or retro-commissioned. According to the United States Department of Energy, this is accomplished to *"ensure that systems, and equipment in existing buildings meet the original design intent."*[20] This process would include the use of maintenance records that verify whether equipment is at peak performance and working according to factory specifications. State governmental units should provide a detailed and enforceable annual service/maintenance plan for all equipment.

4. Building Envelope Survey and Repairs

[19] https://onlinemba.unc.edu/news/how-lighting-affects-productivity/
[20] https://www.energy.gov/eere/femp/commissioning-federal-buildings

A building envelope survey should be done to assess and document the overall condition of the exterior of the possible lease facility. This survey should include things such as door weather stripping, caulking around windows, and whether energy efficient windows and doors are in place. If possible, this survey should utilize thermo-imaging cameras to detect issues that cannot be seen with the human eye. The shell of the building is constructed only once but stands as the only protection from outdoor conditions. This shell is designed to eliminate the transfer of heat and cold both from the interior and exterior of the building. All efforts to improve building insulation and to repair air leaks will improve the overall efficiency of the building. Without these weatherization improvements, energy efficiency measures will

5. Energy Policy

Government entities should have an enforceable energy policy which covers both leased and owned properties. This policy should address temperature set points, plug load, occupant behavior, personal appliances, and efficiency of equipment within these facilities. In addition, the policy provides direction to employees and specifies operational parameters of equipment that can be controlled to ensure stewardship of taxpayer funds and environmental resources.

5.2 Funding Methods

<u>Federal Stimulus Funds</u>

A. Inflation Reduction Act

The 117th United States Congress enacted the Inflation Reduction Act on August 16th, 2022 under President Joe Biden's term. The Act delegates $369 billion to programs and initiatives toward climate resilience, energy efficiency improvements, and energy security programs. Section 13303 of H.R. 5376 amends and extends the possible tax credits for energy efficient upgrades on commercial buildings (179D) including tax-exempt, state-owned buildings. The primary designers of energy efficiency upgrades (i.e., engineers, architects, contractors, energy service providers, and environmental consultants) are qualifying entities for these deductions, which may incentivize lower-cost contracts for state-building energy upgrades. Beginning January 1st, 2023, upgrades that result in a 25% or more decrease in energy usage intensity per year are eligible, and deductions are available on a sliding scale from $2.50 to $5 per square foot. Energy efficient upgrades completed before 1/1/23 are also eligible for an inflation-adjusted deduction of up to $1.88 per square foot. This new tax deduction model provides financial incentive to improve energy efficiency to the highest degree and will supplement NC's EO80 goal at a federal level.

Section 50131 of H.R. 5376 also supports commercial building energy code developments with $1 billion dollars in national funding to the Secretary of State. These funds can be utilized by both state and local governments to adopt and implement new building energy codes in order to meet or exceed the zero energy provisions of the 2021 International Energy Conservation Code (IECC). These funds will be essential for NC's SEO to make progress towards the EO80 goal and provide additional precedence to decommission or upgrade commercial, including state-owned, buildings that are energy inefficient. Additionally, these codes will ensure that newly constructed buildings meet required energy efficiency standards.

Section 60103 of H.R. 5376 expands the Clean Air Act, 42 U.S.C. § 7434 to include § 134, which ratifies the Greenhouse Gas Reduction Fund (GGRF). Under advisement of the Environmental Protection Agency (EPA), $27 billion are available in the form of competitive grants until September 30, 2024. State entities, such as SEO, are eligible for $7 billion of the GGRF to implement projects that will benefit low-income and disadvantaged communities by reducing GHG emission or implementing innovative, zero-emission technologies. SEO envisions applying these funds to blend energy advancement projects from EO80 initiatives to support the Justice40 Initiative, designing an infrastructure that reduces the energy burdens for low-income and disadvantaged communities. For example, addition of rooftop solar power to state-owned buildings may be used to offset power needs of not only state-buildings, but also energy requirements of local residents. These funds provide North Carolina with the opportunity to move towards creating a community solar infrastructure between commercial, state-owned buildings and the residential sector.

B. Infrastructure Investments and Jobs Act

The bipartisan Infrastructure Investments and Jobs Act (IIJA) was signed into law on November 15th 2021, allocating $1.2 trillion to create opportunities for states, tribes, and local governments to invest in infrastructure towards green energy, energy equity, and climate resiliency. Under Section 40552 of H.R. 3684, the Energy Efficiency and Conservation Block Grant (EECBG) program provides $550 million to improve transportation and building infrastructure. The SEO may apply for these grants, which could financially support the addition of electric vehicle charging infrastructure into state-owned parking decks and building energy efficiency upgrades, including renewable energy off-sets, to meet the EO80 goal of a 40% energy usage intensity reduction by 2025.

<u>Storm Recovery and Resiliency Funding</u>

A. Building Resilient Infrastructure and Communities (BRIC)

On October 5, 2018, the Disaster Regulatory Reform Act was signed into federal law by the President of the United States. Section 1234 of the Act authorized the Federal Emergency Management Agency (FEMA) to annually set aside 6% of expenses from each Presidentially-declared major disaster declaration to create and fund the BRIC grant program. The BRIC program supersedes the Pre-Disaster Mitigation program and is focused on nationwide hazard mitigation projects. For the 2021-2022 grant cycle, FEMA allocated approximately $2.295 billion through the BRIC program to fund resilience projects that reduce risk and damage from future natural hazards, are cost effective, consider the effects of climate change and carbon emissions generated, meet the latest two consensus codes, are technically feasible, align with the State or Tribal Mitigation Plan, promote equity and inclusion of disadvantaged groups in accordance with the federal "Justice40 Initiative"[21], and meet all environmental and historic preservation requirements. Of that amount, $112 million *(up to $2 million per <u>applicant</u>)* is designated for all states and territories, $50 million is set aside for tribal governments *(up to $2 million per <u>applicant</u>)*, and $2.133 billion is estimated to remain in the national competition after allocations to states, territories, or tribal governments are made *(up to $50,000,000 per <u>sub-applicant</u>)*. All states and territories that have had at least one Presidentially-declared major disaster declaration within the past seven years are eligible unilaterally apply as "applicants" or on behalf of "sub-applicants".

[21] Executive Order 14008; January 27, 2021; https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf

For the purposes of North Carolina, the "applicant" is deemed to be the DPS's Division of Emergency Management Division (NCEM), while "sub-applicants" are deemed to be state agencies, local governments, and federally-recognized tribal governments.

The BRIC program emphasizes that successful projects reduce risks to as many of the seven "community lifelines" as possible, promote equity for disadvantaged groups, and incorporate nature-based solutions. The BRIC program also prioritizes projects that enhance resilience while conforming to the latest two consensus building codes, a criterion that challenges North Carolina applications due to the state's adherence to older building code standards. These criteria ensure that projects provide long-term solutions to prepare communities before disasters and will quickly prevent an unforeseen chain of negative events after disasters. The "community lifelines" are critical services that communities use including: (1) safety and security; (2) food and water; (3) shelter; (4) health and medical; (5) energy (power and fuel); (6) transportation; and (7) hazardous materials. The formation of partnerships with public, private, and non-profit organizations could assist with incorporating several lifelines into project proposals in addition to providing cost-sharing. Projects are graded based on technical *(all or nothing for credit)* and qualitative criteria *(partial credit allowed)* per FEMA's project specifications. For FY 2021-2022, the cost share of projects is generally 75% federal and 25% non-federal. It is important to note that FEMA will pay up to 90% of costs for *"Economically Disadvantaged Rural Communities"* which is defined as an area of less than 3,000 people that earn less than 80% of the national per-capita income[22].

State agencies may be eligible to utilize the BRIC funding opportunity to improve the resiliency and energy efficiency of state-owned infrastructure if key project elements were incorporated into North Carolina's 2022 Enhanced Hazard Mitigation Plan (HMP). However, without proactively including key project elements into the HMP, proposals from state agencies may not be eligible to move forward in NCEM's official application to FEMA.

B. North Carolina Disaster Recovery Framework (NCDRF)

In 2018, the NCEM established twelve "Recovery Support Functions" (RSFs) as part of the NCDRF to address long-term planning, resiliency, and recovery goals in North Carolina[23]. Each RSF consists of several stakeholders from governmental and non-governmental organizations to provide technical subject-matter support, suggest policies, or request legislation to achieve the framework's goals and mission for future events. As such, the USI program recommends that the energy-efficiency and resiliency of state-owned buildings be explored and prioritized in RSF #5 (Transportation & Infrastructure) to align with the key goals of EO80. These buildings are an area that would greatly benefit from future state-funded opportunities or methodologies to assist with reducing annual energy intensity and costs. While RSF #5 has not met since the last report, future efforts for state-owned buildings could be coordinated through the North Carolina Office of Recovery and Resilience.

[22] Cost Share Requirements, Pre-Award costs and Management Costs; https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply

[23] *2019 NORTH CAROLINA Disaster Recovery Framework;* https://files.nc.gov/ncdps/documents/files/2019-NC-Disaster-Recovery-Framework-FINAL.pdf

Guaranteed Energy Savings Contracts

Since 2002, GS §143-64.17 allows for governmental units to utilize the GESC process to implement and to finance major facility upgrades which save energy and reduce utility expenditures. Under the law, the energy savings resulting from the performance of the contract must equal or exceed the total cost of the contract. Furthermore, the contracts are not to exceed a term of 20 years from the date of the installation and acceptance. Based on the rules in *Title 01 NCAC Subchapter 41B,* an Energy Services Company (ESCO), in collaboration with the affected governmental units works to: (1) design and propose a package of energy conservation measures (ECMs); (2) install the selected ECMs; (3) provide measurement and verification of the annual savings for the duration of the contract; and (4) guarantee the dollar savings of the energy savings through a third-party reviewer. Utility budget savings caused by the implementation of the guaranteed ECMs provides repayment of the multi-year loans executed by governmental units to finance the initial energy upgrades. Governmental units are encouraged to utilize the GESC process to fund capital projects that will assist in meeting the EO80 goal. The USI program's staff are equipped to provide technical assistance and guidance throughout the GESC process.

Three cabinet agencies; DOA, DOT, and DPS have historically used this method of finance for energy efficiency improvements. To date, DOT has accumulated savings of almost $1.3 million dollars above the guarantee for their two projects, and DPS has saved over $0.94 million dollars above the guarantee for their project.[24] USI is overseeing an additional seventeen projects within the UNC System that have an expected guaranteed savings of over $333 million through the life of the contracts.[25] With the success of these projects, DPS and DNCR are in the process of implementing GESCs for their state buildings. The DNCR project includes the North Carolina Zoo, all three aquariums and five museums. The DPS project is for six 1000 cell correctional facilities. Agencies and the UNC System have proven that GESC works and works well for completing energy projects. Using a GESC allows state agencies to obtain large-scale improvements in record time, with a single vendor, and with a guaranteed energy savings that is validated by a third-party as required by statute. GESC continues to be a valuable method of funding energy improvement projects and should be utilized to the maximum extent if EO80 agency goals are to be achieved.

Energy Efficiency Repair and Renovation Funds

Each agency makes annual requests for repair and renovation (R&R) budgets. These requests contain capital projects, maintenance issues, aging equipment, and infrastructure necessary to maintain the current use of existing facilities. Historically, energy efficiency projects competed against critical "life safety" improvements; however, USI and OSBM worked together during the past year to create an annual monetary budget that is set aside and dedicated solely to energy efficiency measures. For example, during FY2021-22, cabinet agencies were permitted to collectively leverage up to $30 million in much needed funding for energy projects that were pre-approved by USI's technical staff. Overall, this is a positive step towards achieving greater efficiency gains and providing stewardship of taxpayer funds.

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[24] We were unable to verify DOT and DPSs accumulated savings since there was not a final third-party review was not provided to DEQ for each fiscal year (per NC GS143-64.17M).
[25] NC Ag and Tech State University's data was excluded from the total since they did not provide a final report or contract for USI's review.

Duke Energy's Energy Efficiency Opt-In Program

Duke Energy offers an energy efficiency plan for customers to choose whether to "opt-in" and take advantage of energy savings programs. The purpose of these programs is to encourage installation of high efficiency equipment. Participants generally pay a little more on monthly power bills but can then purchase high efficiency equipment or lighting at a reduced price or with rebates. In this manner, Duke Energy incentivizes a portion of the higher cost of energy efficient installations and maintenance activities. Alternately, customers may elect not to participate or "opt-out" of the energy efficiency and/or demand-side management programs and receive a monthly bill credit. Customers are encouraged to use these monthly savings to fund and implement their own efficiency measures. However, one potential issue is that many customers that opt-out do not use their savings for energy efficiency as the program was designed.

Duke Energy's Small Business Energy Saver Program

Duke Energy's Small Business Energy Saver program offers up to 80% savings on energy efficiency improvements for small businesses. This program is available to nonresidential customers with an average annual demand of 180 kilowatts or less. They have a dedicated contractor that performs free energy assessments for potential program participants. From the assessment, recommendations are made based on the business type and operating hours. Overall, savings vary with the combination of recommendations and type of equipment that is replaced. The process is simple since the contractor counts all the light fixtures, calculates the savings/payback, and does the installation. The result is a turnkey project consultation and installation where the participant receives cash rebates to encourage the purchase and installation of high-efficiency lighting, HVAC systems, commercial and agricultural equipment, as well as equipment for industrial and governmental facilities. These rebates are available for both new construction and retrofit of existing or replacement of failed equipment. Duke Energy will also provide consultation services to make sure that a customer is getting the right rebate or incentive. Both DEQ and DPS have used this program successfully to upgrade lighting in a number of facilities within Duke Energy's service territory. Hopefully, more governmental units will take advantage of this program for some of their energy efficiency upgrades in the future.

Energy Savings Credits

One barrier all governmental energy programs face is a lack of funding for efficiency improvement projects. In this regard, the UNC System and affiliates benefit from a statutory provision that was created under SL 2010-196, Sections 1 and 2 (NCGS 116-30.3B). This provision allows the UNC System and affiliates to retain funds annually left over in their utility accounts by measuring and receiving third-party verification on energy savings associated with utility saving projects completed during the same fiscal year. These funds are credited into the next fiscal year's budget with the requirement that at least 60% of those funds must be used for more energy related projects. This provides an incentive to install projects which generate energy savings because a portion of the funds are credited back and can then be used for more efficiency projects. Over time, projects become larger thereby resulting in greater savings. For FY 2021-22, eleven UNC System schools asked to carry forward over $14.4 million in savings and reported spending an additional $9.2

million for new energy efficiency projects.[26] These funds are specifically designated for energy efficiency improvements.

Figure 7 shows the previous fiscal year's estimated avoided energy costs of the top five agencies that totaled $40 million. If these agencies had a more permanent, clear, and reliable mechanism like NCGS 116-30.3B (i.e., outside the dedicated energy efficiency R&R funds), some of this avoided cost could have been utilized to self-fund additional energy efficiency projects.

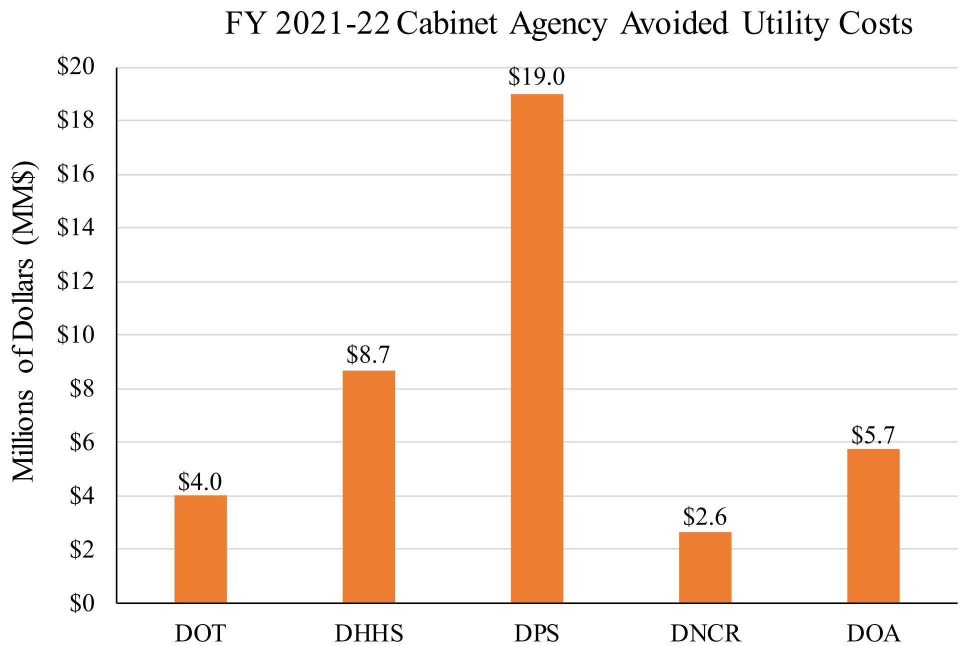

Figure 7: Cabinet Agency Avoided Energy Costs

6.0 Conclusion

The pandemic and data corrections have had an impact on the collective state-owned building's EUI reduction. However, this report emphasizes that significant energy conservation measures and resources are needed by all state sectors in order to achieve the EO80 40% EUI reduction goal by 2025. If these measures and resources are not completed by FY2023-24, the EO80 -40% EUI goal may not be achieved. Hiring full-time dedicated energy managers with decision-making authority and access to specific funding for energy improvements would assist substantially in this effort. Management must empower these energy managers and fully support EUI reduction initiatives both with communicating energy efficiency goals and with providing leadership in making sure the goals are achieved. Improved data collection efforts are underway within several state agencies, but all governmental units would benefit from a comprehensive and centralized

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[26] *It should be noted that SEO found historical data entry and formula errors in the official "carry forward" submittal to OSBM for North Carolina Central University [$15,915 improper credit], UNC Chapel Hill [$103,270 improper exclusion], and UNC Pembroke [$70,970 improper credit] that impacts the total claimed savings specified in this report. In addition, there was a separate data entry error for the "cost of new projects" for East Carolina University [$800 overage] and North Carolina State University [$2.28MM overage] that collectively overestimated data for the category. The values in this report reflect the most accurate tabulation of the "savings claimed" and "cost of new projects" for FY2021-22 based on datasets provided by participating UNC System schools.*

utility data collection system. This would be instrumental in helping energy managers to identify and to address areas of greatest improvement. Similarly, all governmental units need to consider alternative financing mechanisms for energy efficiency projects such as GESCs. A prudent way to schedule energy upgrades is by developing a well-written utility management plan which is another area needing improvement within all sectors. As employees and students return to offices and campuses, utilizing high volumes of outside air for heating and air conditioning systems are not an energy efficient long-term solution for COVID-19 health and safety measures. Other technologies should be considered and building schedules adjusted to flush air from occupied spaces. Also, directives should be implemented to prevent purchasing non-LED lamps or fixtures throughout all government sectors. Energy conservation measures for leased spaces provide an opportunity for all sectors to reduce energy consumption and costs while indirectly promoting the private sector to become more efficient to meet contracting standards.

Overall, cabinet agencies, other agencies, and the UNC system spent over $324MM on utilities in FY 2021-22. Proper stewardship of these funds requires energy conservation measures and a focus on energy efficiency. This message must come directly from leadership and filter through all levels of governmental sectors. Due to the plethora of upcoming stimulus and grant funding opportunities, state agencies and UNC System institutions have monetary opportunities for financial reinforcements that are necessary to move towards and reach the collective -40% EUI goal by 2025. Now, more than ever, a reinvestment in energy efficiency is necessary for North Carolina to continue as a national leader in energy conservation. The USI team is prepared to support and to assist with all these efforts and to drive future energy savings across the state. Everyone must work together to conserve North Carolina's valuable resources.

Appendix A

Agency Summaries, Data, and Graphs

Department of Administration (DOA)

The Department of Administration acts as the business manager for North Carolina State government. The Department oversees Government Operations, which includes the maintenance of state-owned buildings and grounds. The DOA Division of Facility Management has been tracking electrical and natural gas consumption data for buildings owned and maintained by DOA monthly since 1998. The Division is also responsible for operating and maintaining DOA buildings, including paying the water, electric, and natural gas utility bills. DOA operates a central steam heating plant, two chilled water plants, and chilled water storage tanks. Most large DOA buildings are in the Downtown Government Complex with the majority being offices, but also includes the steam and chilled water plant. The buildings are mostly occupied by agencies other than DOA with DOA serving as landlord. Brittany Morra, Bob Talley, and Ralph Taylor work together to improve the energy efficiency and sustainability of DOA facilities.

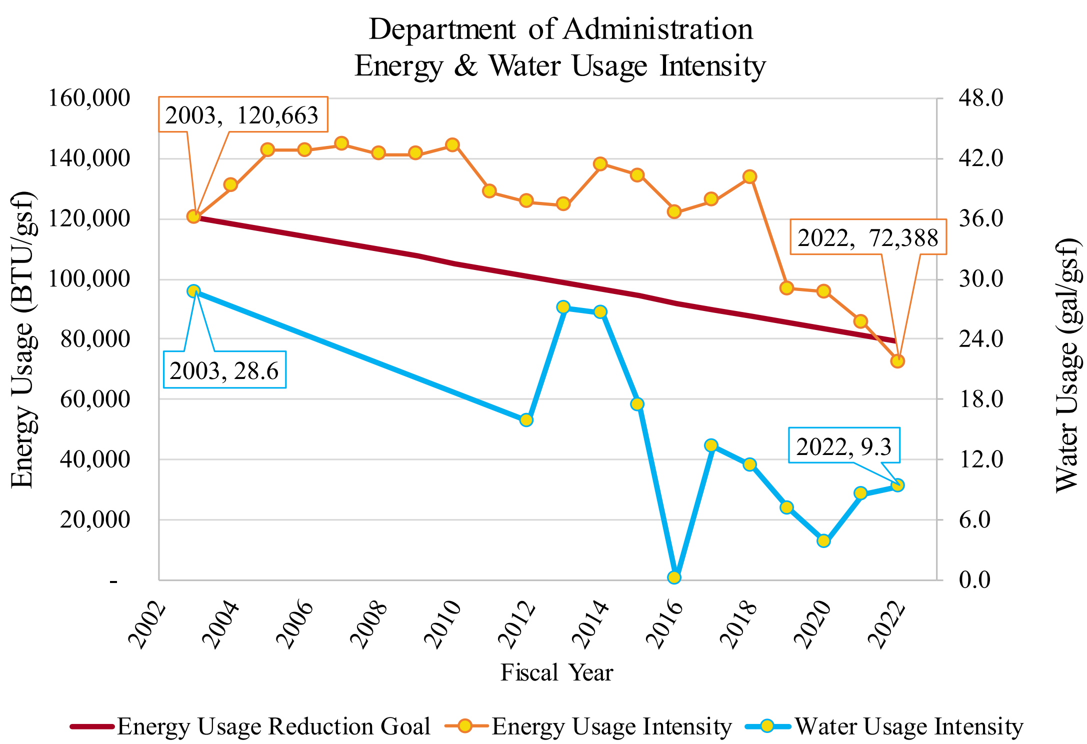


Figure A.1: DOA Utility Usage Over Time

Table A.1: DOA Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	4,798,719	5,633,589	+17%
Total Utility Cost	$8,927,218	$6,766,585	-24%
Energy Usage (Btu/gsf)	120,663	72,388	-40%
Energy Cost ($/MMBtu)	$14.89	$14.46	-3%
Water Usage (gal/gsf)	29	9	-67%
Water Cost ($/kgal)	$2.23	$16.57	+644%

Department of Commerce (DOC)

The DOC's mission is to *"work closely with local, regional, national, and international organizations to propel economic, community, and workforce development in the State."* To accomplish this task, the DOC is comprised of several divisions and programs that assist businesses with siting and workforce requirements, connecting the community with funding opportunities to attract new businesses, and publishing analytical reports for those interested in investing in North Carolina's economy. Except for the Division of Employment Security's (DES) Central Office, all business operations are housed in properties that are owned by the Department of Administration (DOA) or leased. Therefore, the DES is the only entity that is required to report utility consumption through the DOC in accordance with GS §143-64.12 and EO80, Section 8. Joe Katzberg who is the Director of Support Services is designated as the energy manager for DES.

Water data for DOC could not be obtained due to a bypass line around the meter that prevents the agency from receiving accurate consumption readings.

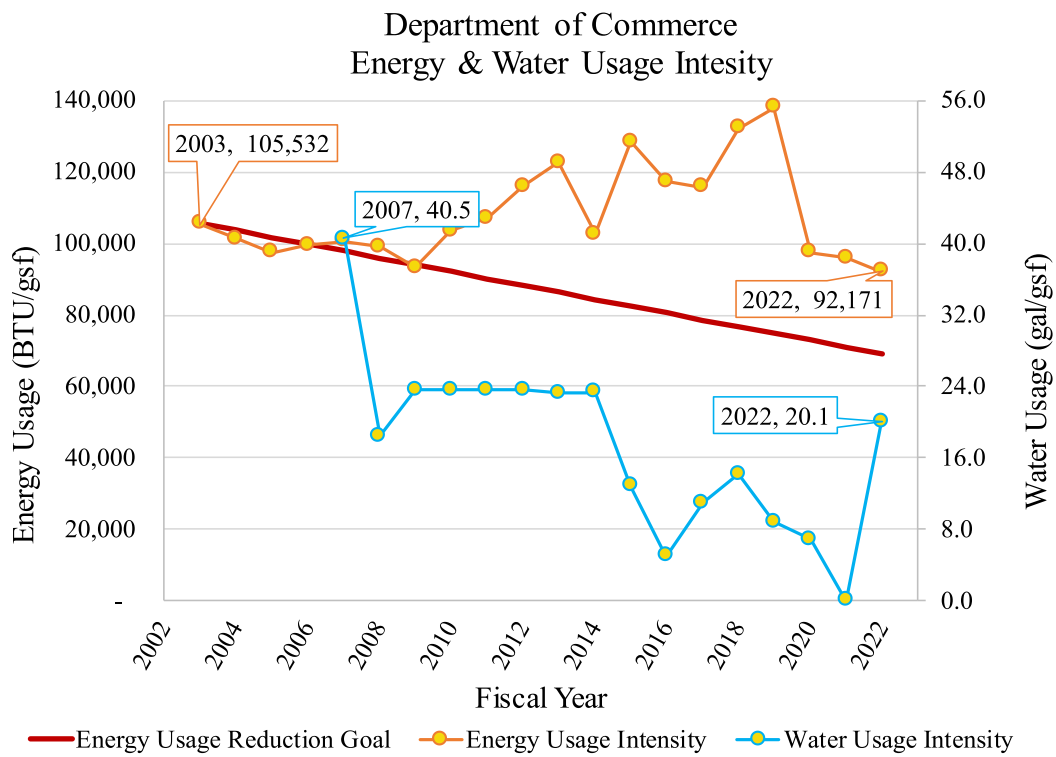


Figure A.2: DOC Utility Usage Over Time

Table A.2: DOC Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	8,784,848	9,628,207	+10%
Total Utility Cost	$9,341,426	$11,411,289	+22%
Energy Usage (Btu/gsf)	53,296	37,263	-30%
Energy Cost ($/MMBtu)	$17.02	$24.76	+45%
Water Usage (gal/gsf)	30	28	-6%
Water Cost ($/kgal)	$5.24	$9.40	+79%

Department of Environmental Quality (DEQ)

The DEQ is the lead stewardship agency for the protection of North Carolina's environmental resources and has offices from the mountains to the coast. Chief responsibilities include administering regulatory programs designed to protect air quality, water quality, and the public's health along with advancing energy efficiency. The majority of DEQ employees work in buildings owned by the DOA or in leased buildings which are not included in the utility data of this report. Only the state-owned facilities currently managed by DEQ are measured and tracked for the DEQ utility data. These facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. Mr. Eric Turon based in Raleigh is the DEQ Facilities Engineering Manager. 2002-03 baseline data was estimated for DEQ to track EO80 progress, but this exercise could not be done for every year between 2002-03 and 2010-11 due to data availability limitations. Therefore, the figure below begins with DEQ's utility data in the 2010-11 fiscal year.

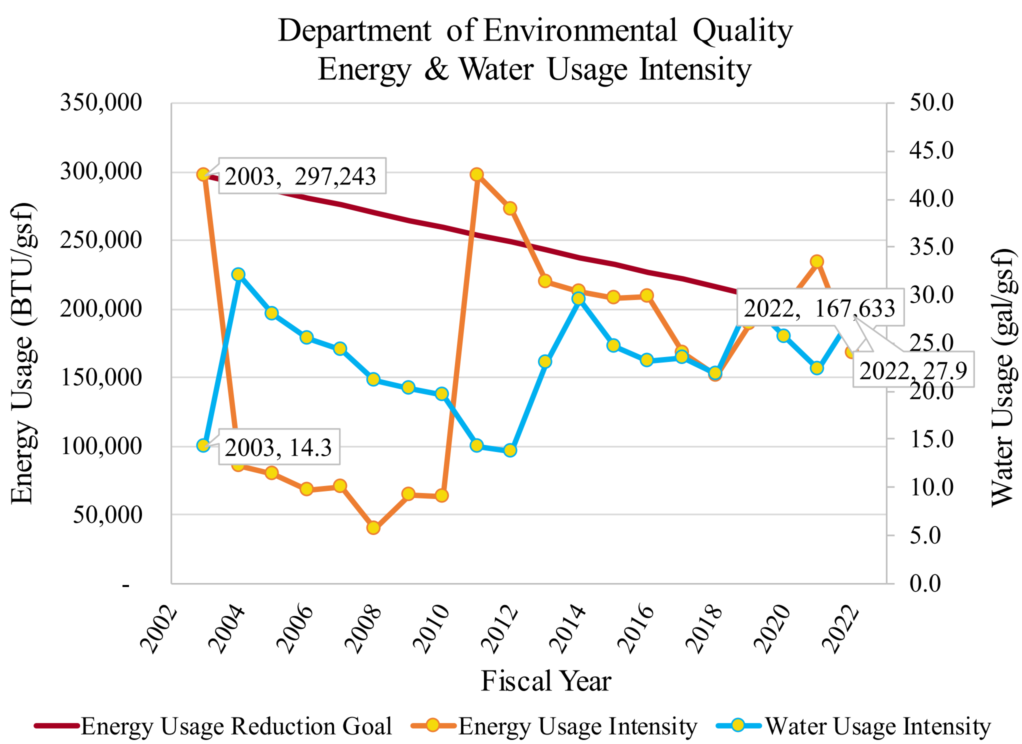


Figure A.3: DEQ Utility Usage Over Time

Table A.3: DEQ Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	105,527	99,355	-6%
Total Utility Cost	$572,246	$302,058	-47%
Energy Usage (Btu/gsf)	297,243	167,633	-44%
Energy Cost ($/MMBtu)	$17.56	$15.54	-11%
Water Usage (gal/gsf)	14	28	+96%
Water Cost ($/kgal)	$14.21	$15.56	+10%

Department of Health and Human Services (DHHS)

The DHHS manages the delivery of health and human-related services for all North Carolinians, especially our most vulnerable citizens; children, elderly, disabled and low-income families. The Department works closely with health care professionals, community leaders and advocacy groups; local, State, and federal entities; and many other stakeholders to make this happen. The Department is divided into 30 divisions and offices. DHHS divisions and offices fall under four broad service areas: (1) health; (2) human services; (3) administrative; and (4) support functions. DHHS has approximately 635 buildings at 14 different institutions across the State encompassing roughly 7.6 million square feet of space. These institutions include psychiatric hospitals, neuro-medical treatment centers, alcohol and drug abuse treatment centers, developmental centers, and vocational rehabilitation centers. The Energy Manager for DHHS is Greg Johnson. Mr. Johnson is housed within the Division of Property and Construction where his primary role is as a Building Systems Engineer.

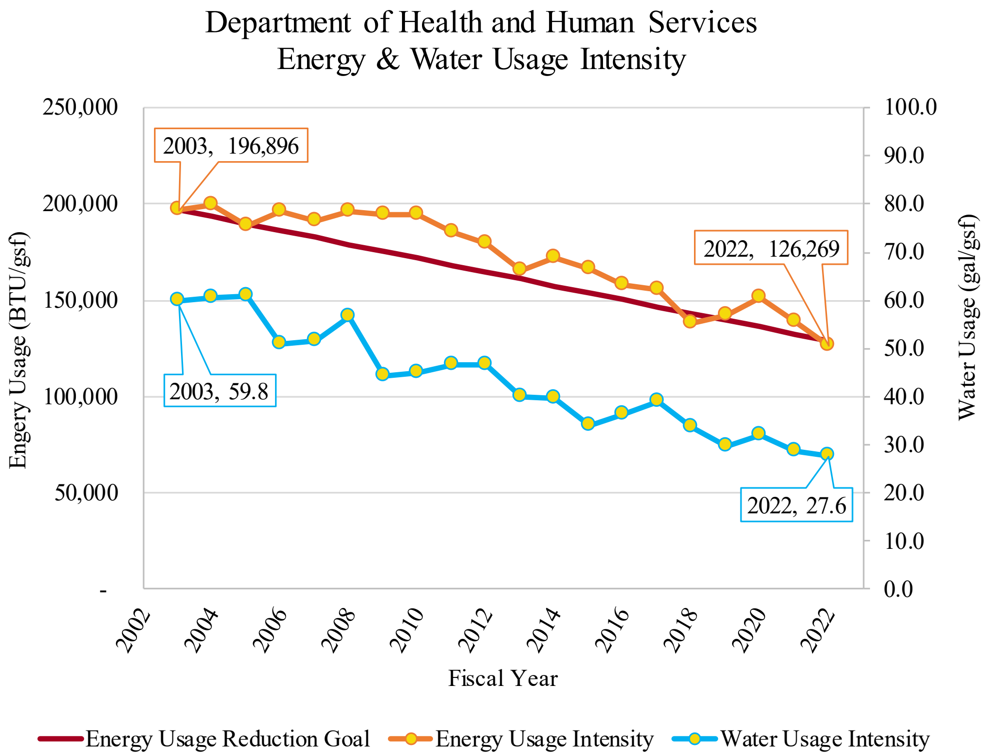


Figure A.4: DHHS Utility Usage Over Time

Table A.4: DHHS Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2021-22	% Change
Total Gross Square Feet	6,381,007	6,363,819	-0%
Total Utility Cost	$12,834,405	$13,456,862	+5%
Energy Usage (Btu/gsf)	196,896	126,269	-36%
Energy Cost ($/MMBtu)	$9.23	$14.43	+56%
Water Usage (gal/gsf)	60	28	-54%
Water Cost ($/kgal)	$3.25	$10.58	$2.26

Department of Information Technology (DIT)

The DIT has two data centers totaling almost 150,000 square feet. The Eastern Data Center (EDC) located in Raleigh is nearly 40 years old. The Western Data Center (WDC) located in Forest City is 13 years old. The nature of DIT's Data center facilities differs from most State buildings since their energy consumption is constantly variable depending on the number of servers, network, and other types of information technology (IT) equipment in use at any given time. DIT offers numerous IT services supported by the Data centers to other state agencies. Floor hosted options are also offered to the agencies where they can utilize a spot on the Data floor with a DIT supplied rack, power, and cooling. As state agency's IT requirements change over time, there is a general upward trend in the power consumption needed. The Energy Manager for DIT is Tony Brackett. Mr. Brackett is housed at the WDC location where his primary role is the WDC Facilities Manager.

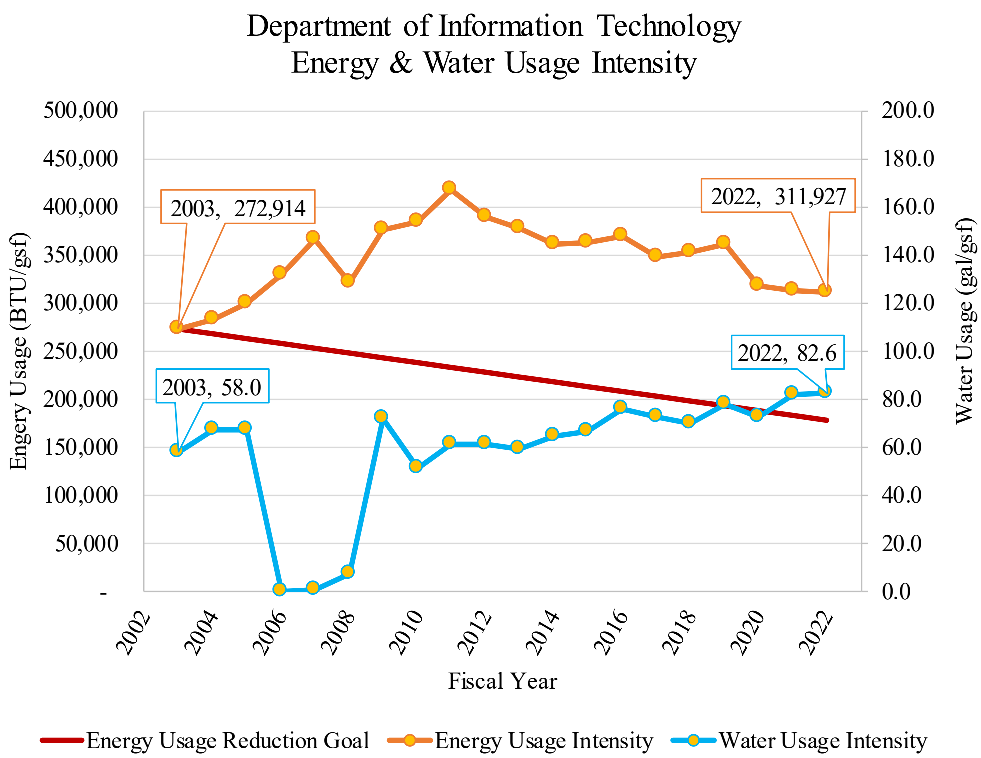


Figure A.5: DIT Utility Usage Over Time

Table A.5: DIT Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	94,343	163,866	+74%
Total Utility Cost	$362,255	$1,111,889	+207%
Energy Usage (Btu/gsf)	272,914	311,927	+14%
Energy Cost ($/MMBtu)	$13.67	$18.72	+37%
Water Usage (gal/gsf)	58	83	+42%
Water Cost ($/kgal)	$1.90	$11.47	+504%

Department of Military and Veteran's Affairs (DMVA)

The DMVA is the newest of the State agencies dedicated to helping veterans and active-duty men and women access the programs, benefits, and resources that they have earned. DMVA staff are committed to providing the highest level of service, responsiveness, and integrity in keeping the principles and values of this State and nation that military personnel and their families deserve. DMVA assists with the management of four military Skilled Care Nursing Homes housing almost 450 veterans and is in the construction phase of a 120-bed home with plans to build a sixth home. NC has one of the largest military footprints of any State, representing three out of the four branches. Military and defense industries are the second largest employers in our State and the military has an economic impact of over $66 Billion dollars annually. The energy manager is Cecil Holt. Mr. Holt is the DMVA Architect, on loan from the State Construction Office.

No agency-specific utility graphs/tables are included here because the DMVA utilities are paid through federal funds.

Department of Natural and Cultural Resources (DNCR)

The N.C. Department of Natural and Cultural Resources oversees the State's resources for the arts, history, libraries and nature. This includes 27 historic sites, seven history museums, two art museums, two science museums, three aquariums, 39 State parks and recreation areas, the N.C. Zoo, the N.C. Symphony, the State Library, the State Archives, the N.C. Arts Council, State Preservation Office, Office of State Archaeology, the African American Heritage Commission, and the Office of Land and Water Stewardship. This comprises approximately 1825 buildings across the State which account for over three million gross square feet of space. Tony Romaine is the energy manager for DNCR, but his primary position is a Facility Construction Engineer with the Capital Projects Unit based out of Raleigh. 2002-03 baseline data was estimated for DNCR to track EO80 progress, but this exercise could not be done for every year between 2002-03 and 2010-11 due to data availability limitations. Therefore, the figure below begins with DNCR's utility data in the 2010-11 fiscal year.

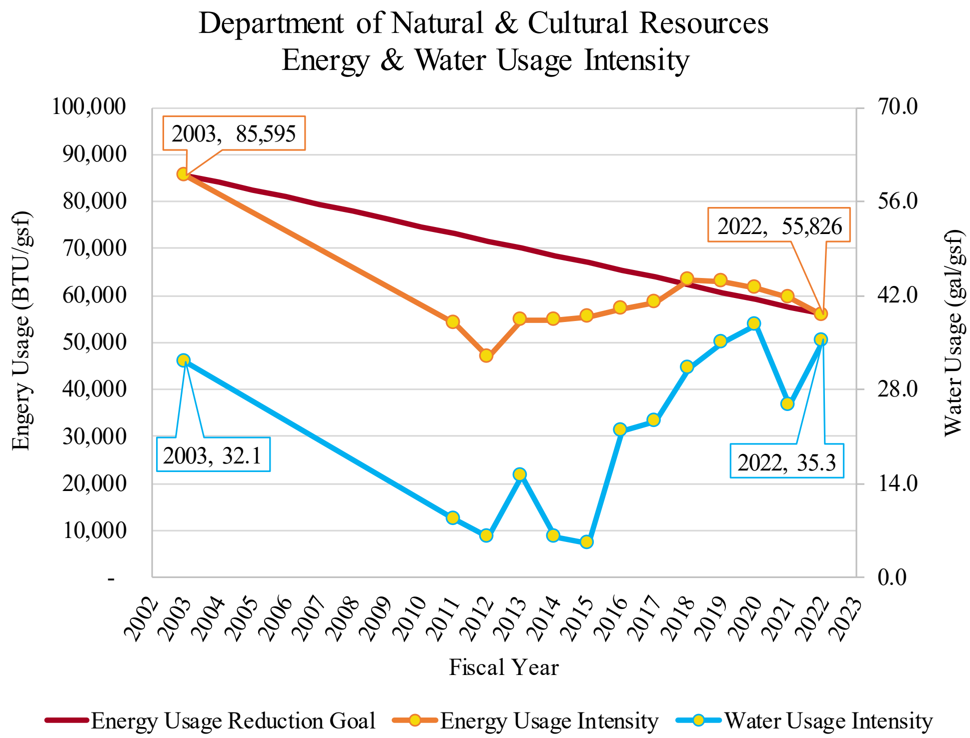


Figure A.6: DNCR Utility Usage Over Time

Table A.6: DNCR Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2021-22	% Change
Total Gross Square Feet	2,291,088	3,363,385	+47%
Total Utility Cost	$3,808,442	$6,207,944	+63%
Energy Usage (Btu/gsf)	85,595	55,826	-35%
Energy Cost ($/MMBtu)	$17.08	$27.15	+59%
Water Usage (gal/gsf)	32	35	+10%
Water Cost ($/kgal)	$6.25	$9.35	+50%

Department of Transportation (DOT)

The N.C. Department of Transportation, DOT, is responsible for all modes of transportation in North Carolina. This includes highways, rail, aviation, ferries, public transit, and bicycle and pedestrian transportation. The department also oversees the State's Division of Motor Vehicles and the Governor's Highway Safety Program, which promotes safety awareness to reduce highway crashes and fatalities. Additionally, DOT helps expand economic growth opportunities through oversight of the N.C. State Port Authority (NCSPA), N.C. Global TransPark and N.C. Turnpike Authority. DOT combined with the NCSPA occupies a total of 2382 buildings which amount to over nine million gross square feet spread throughout the State. The energy manager for the DOT is Eric Frazier whose primary job title is Energy Management Engineer for the Facilities Management Unit. He works out of the Raleigh DOT headquarters building.

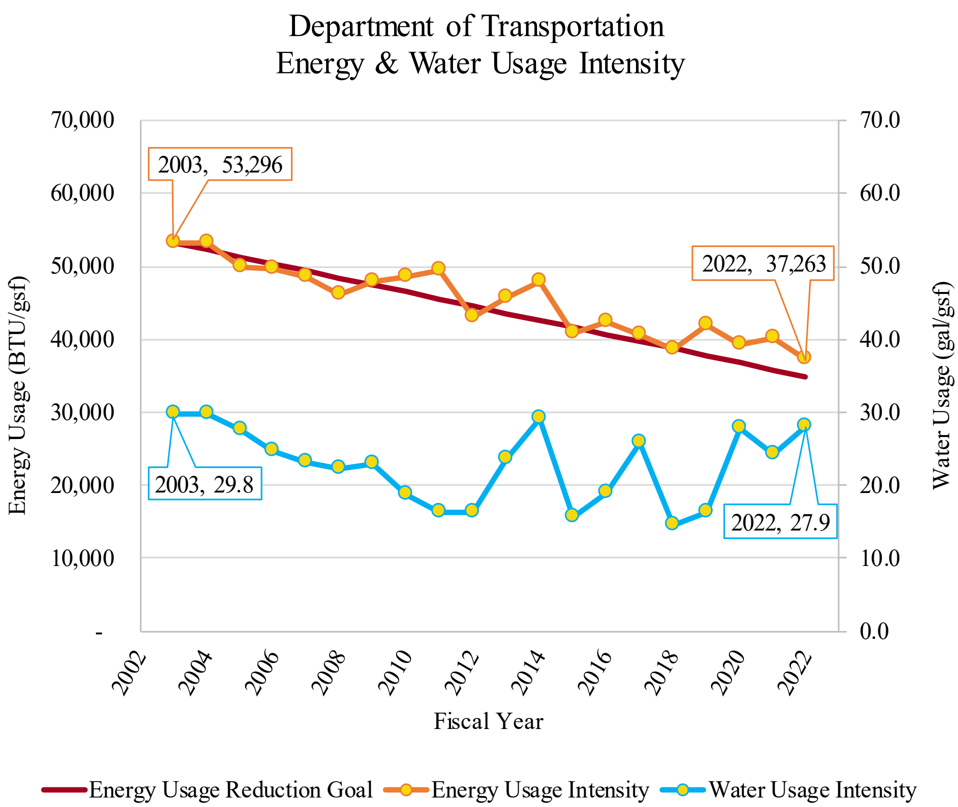


Figure A.7: DOT Utility Usage Over Time

Table A.7: DOT Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	8,784,848	9,628,207	+10%
Total Utility Cost	$9,341,426	$11,411,289	+22%
Energy Usage (Btu/gsf)	53,296	37,263	-30%
Energy Cost ($/MMBtu)	$17.02	$24.76	+45%
Water Usage (gal/gsf)	30	28	-6%
Water Cost ($/kgal)	$5.24	$9.40	+79%

Department of Revenue (DOR)

The DOR is tasked with administering tax laws and collecting tax revenue to fund public services for the citizens of North Carolina. The tax-funded public services include items such as schools, universities, roads, and public safety. To fulfill these tasks, the Department's vision is to protect customer information, maintain an expert workforce, achieve a high-level of understanding and compliance, respond with accurate information through innovative services, and to treat taxpayers fairly. The main DOR office building is located at 501 North Wilmington Street Raleigh, NC, 27604. This building is currently owned by the DOA, and utilities are reported through that agency. The DOR also occupies thirteen remote offices across the State that are housed in leased spaces so those utilities are not included in this report. Matthew King was designated as the energy manager for DOR, but his primary role is as Business Operations Facilities Manager.

No agency-specific utility graphs/tables are included below since the DOR reports utilities through the DOA.

Department of Public Safety (DPS)

The Department of Public Safety (DPS) manages facilities across the State that include prisons, juvenile detention centers, emergency management headquarters, and motor vehicle division sites. Also housed within DPS are the departments of Homeland Security and the National Guard. All of these divisions have the ability to be mobilized at any time and many of these facilities contain populations whose primary concern is not energy efficiency. In fact, many of these locations are required to maintain strict standards of comfort 24 hours a day seven days a week. DPS is the largest user of utilities among all the state agencies, and that utility spending is overseen by Paul Braese, who is the DPS Energy Manager. DPS is the only agency that for many years that has had a dedicated energy manager and a department focused solely on energy management. Paul's team supervises the collection of utility data through the Capturis program and works with other DPS departments performing energy projects and improvements.

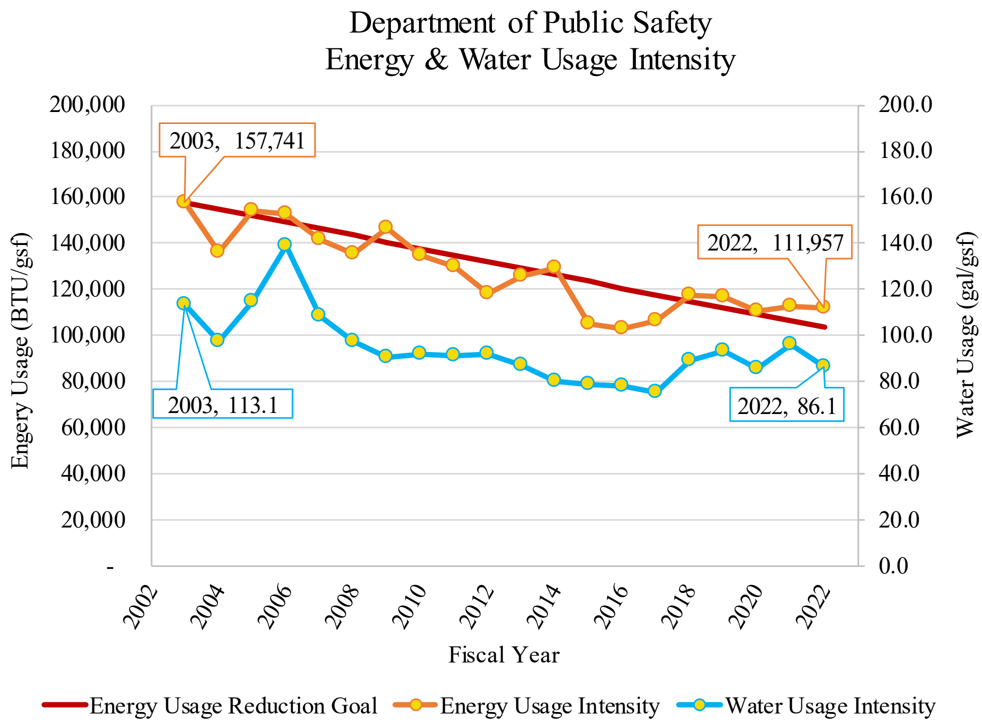


Figure A.8: DPS Utility Usage Over Time

Table A.8: DPS Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	11,581,135	16,943,880	+46%
Total Utility Cost	$32,284,715	$51,463,343	+59%
Energy Usage (Btu/gsf)	157,741	111,957	-29%
Energy Cost ($/MMBtu)	$12.43	$15.80	+27%
Water Usage (gal/gsf)	113	86	-24%
Water Cost ($/kgal)	$7.31	$14.74	+101%

Voluntary EUI Reduction Progress for Other State Agencies

Per EO80, the State of North Carolina strives to reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels. While the executive order applies directly to cabinet agencies, other state agencies are strongly encouraged to adopt the same goal. These other state agencies are the Department of Agriculture and Consumer Services, the Department of Justice, the Department of Public Instruction, and the Division of Wildlife Resources. Also, these agencies were not required under EO80 to appoint an energy manager.

Department of Agriculture and Consumer Services (NCDA&CS)

The North Carolina Department of Agriculture and Consumer Services has facilities across the State that include offices, storage, animal housing, chiller plants, food service, shops, housing, arenas, laboratories, greenhouses, and museums. In 2011, the department underwent major restructuring along with the Department of Natural Resources.

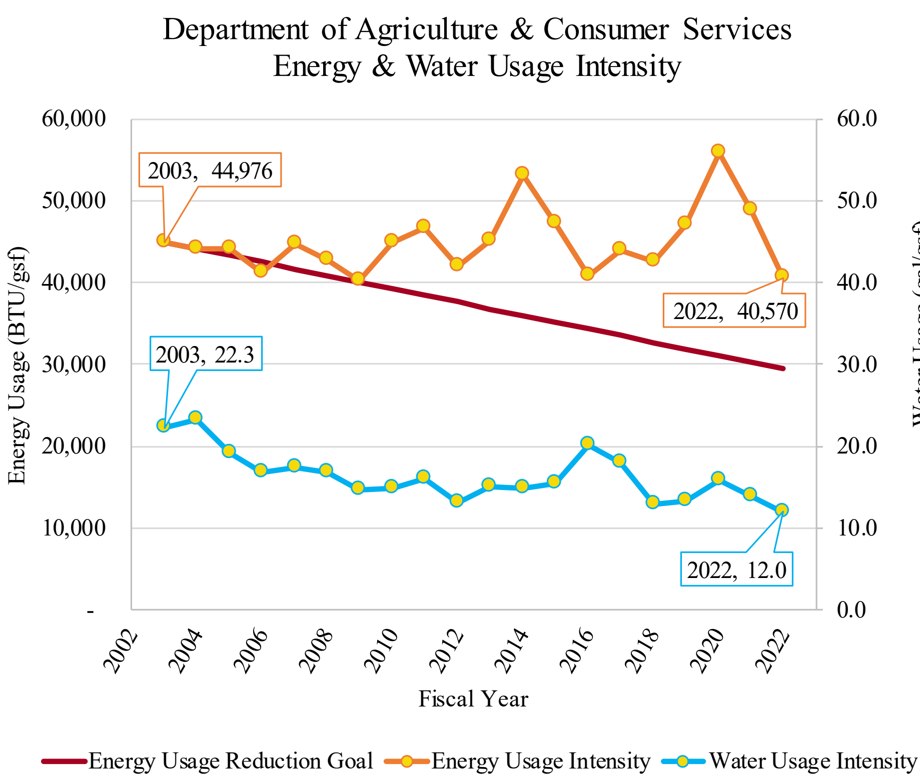


Figure A.9: NCDA&CS Utility Usage Over Time

Table A.9: NCDA&CS Utility Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	2,995,262	4,226,051	+41%
Total Utility Cost	$2,374,024	$4,937,267	+108%
Energy Usage (Btu/gsf)	44,976	40,570	-10%
Energy Cost ($/MMBtu)	$15.41	$23.40	+52%
Water Usage (gal/gsf)	22	12	-46%
Water Cost ($/kgal)	$4.47	$18.25	+309%

Department of Justice (DOJ)

The DOJ has two training academies that provide training for law enforcement personnel. The NC Justice Academies (NCJA) are in Salemburg and Edneyville totaling almost 300,000 square feet. These academies provide basic, intermediate, and advanced training for law enforcement officers (LEOs) on topics including anti-terrorism, community-oriented policing, criminal investigation, traffic crash investigation, firearms, self-defense, and management and supervision. The Western Crime Lab is also located at the Edneyville campus.

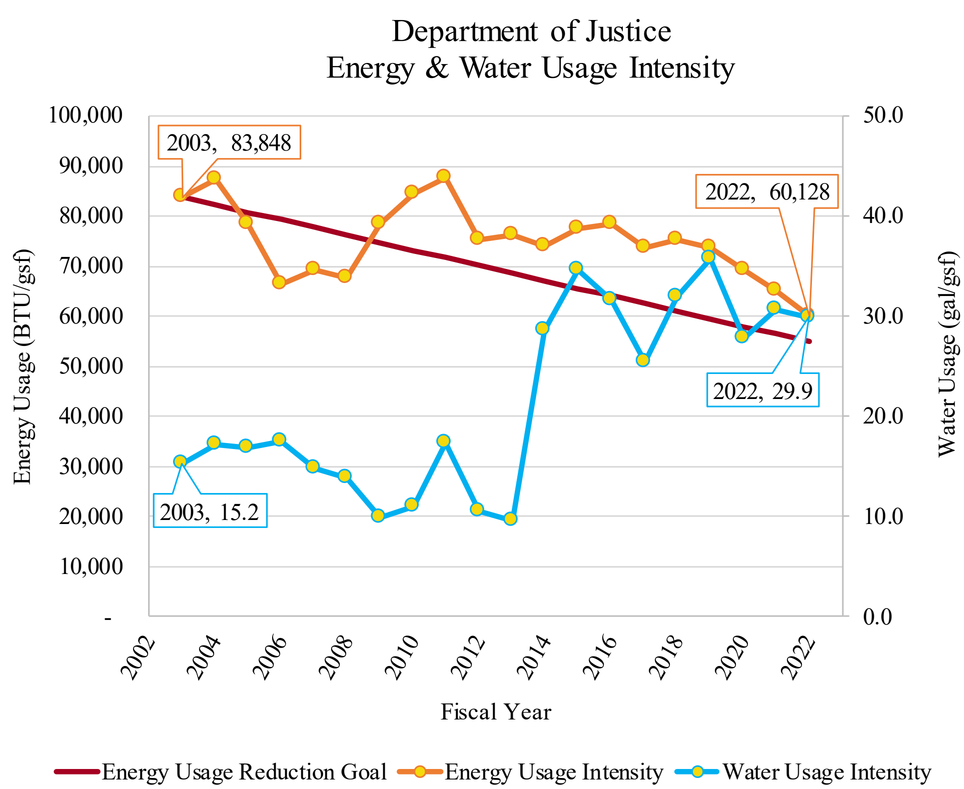


Figure A.10: DOJ Utility Usage Over Time

Table A.10: DOJ Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2021-22	% Change
Total Gross Square Feet	204,206	298,220	+46%
Total Utility Cost	$269,833	$495,967	+84%
Energy Usage (Btu/gsf)	83,848	60,128	-28%
Energy Cost ($/MMBtu)	$15.09	$23.55	+56%
Water Usage (gal/gsf)	15	30	+96%
Water Cost ($/kgal)	$3.71	$8.27	+123%

Department of Public Instruction (DPI)

The DPI administers educational funding, oversees the licensure of teachers and administrators, provides curriculum support, and evaluates student success for public schools. North Carolina's public school system encompasses approximately 2,500 district schools and 180 charter schools that prepare students for the modern workforce and further education. Currently, the department's administrative staff are housed in the Central Office in Raleigh as well as four regional licensing centers in Catawba, Concord, Elm City, and Fayetteville. A fundamental component of DPI is management of the Western School of the Deaf in Cullowhee, Morehead Governor's School in Raleigh, and the Eastern School of the Deaf in Wilson. All three facilities are designed to be residential or day learning institutions for visually or hearing-impaired children. Furthermore, the department leads two North Carolina Centers for the Advancement of Teaching (NCCAT) in Cullowhee and Ocracoke Island that are designed to professionally-develop and improve the classroom effectiveness of teachers. Jonathan Jones is assigned as the primary departmental energy manager for the DPI; however, Jonathan Long, Joshua Burris, and William Putman assist in covering the DPI's diverse geographic area. It is important to note that their energy management duties were applied as an additional requirement to their existing job responsibilities.

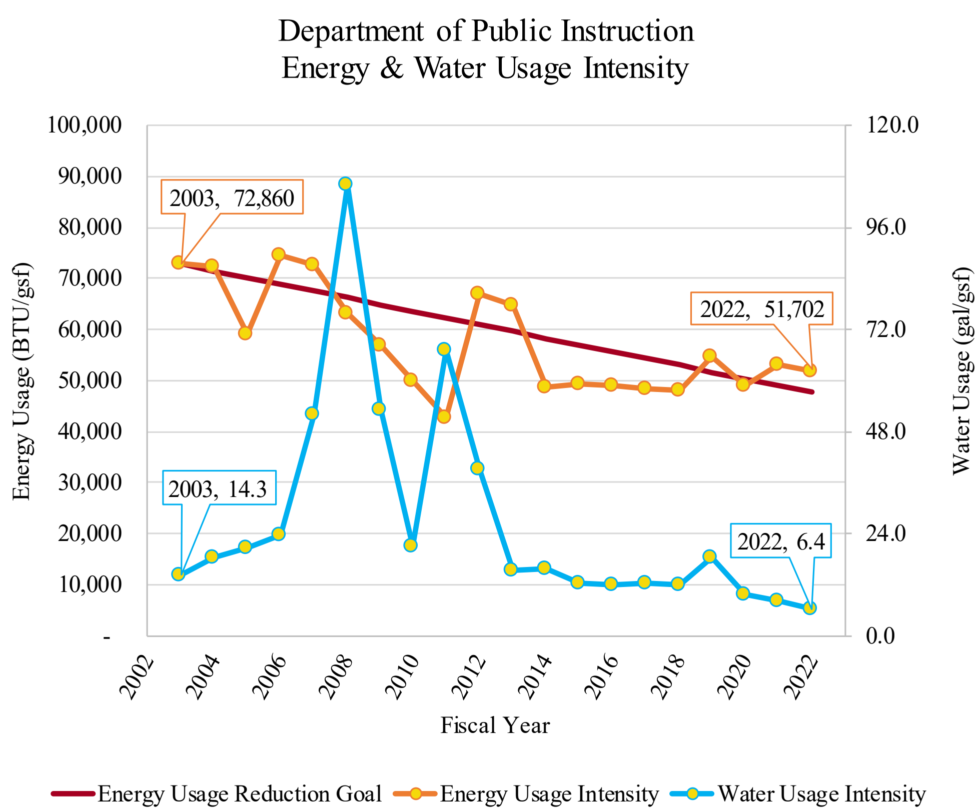


Figure A.11: DPI Utility Usage Over Time

Table A.11: DPI Progress

Metric	Fiscal Year		% Change
	2002-03	2021-22	
Total Gross Square Feet	713,347	663,259	-7%
Total Utility Cost	$747,574	$847,860	+13%
Energy Usage (Btu/gsf)	72,860	51,702	-29%
Energy Cost ($/MMBtu)	$12.91	$23.28	+80%
Water Usage (gal/gsf)	14	6	-55%
Water Cost ($/kgal)	$7.47	$11.63	+56%

Wildlife Resources Commission (WRC)

The N.C. Wildlife Resources Commission conserves and sustains the State's fish and wildlife resources through research, scientific management, wise use, and public input. The Commission is the regulatory agency responsible for the enforcement of fishing, hunting, trapping, and boating laws. Commission buildings are located across the State and include offices, pole barns, equipment storage, workshops, garages, residences, barns, animal housing, and laboratories.

Data is only available for WRC dating back to the 2005-06 fiscal year.

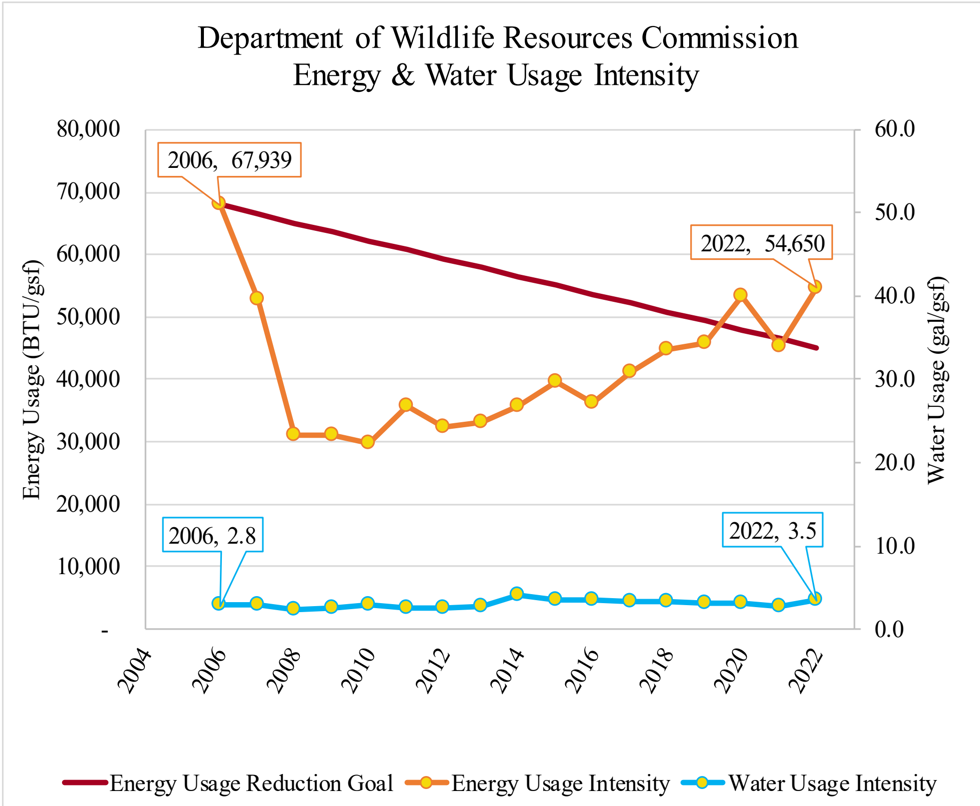


Figure A.12: WRC Utility Usage Over Time

Table A.12: WRC Progress

Metric	Fiscal Year		% Change
	2005-06	2021-22	
ıl Gross Square Feet	161,093	308,390	+48%
ıl Utility Cost	$222,601	$411,040	+46%
rgy Usage (Btu/gsf)	67,939	54,650	-24%
rgy Cost ($/MMBtu)	$20.00	$22.57	+11%
er Usage (gal/gsf)	3	3	+18%
er Cost ($/kgal)	$8.18	$28.55	+71%

Appendix B

Sources and Assumptions Used to Calculate Greenhouse Gas Offsets

Sources and Assumptions Used to Calculate Avoided Greenhouse Gas Emissions

Introduction and Scope

This appendix documents the process to revise the avoided greenhouse gas emissions contained in the December 1, 2021, version of the report titled *"Comprehensive Program to Manage Energy, Water, and Other Utility Use for State Agencies and State Institutions of Higher Learning"*. The emissions were revised by utilizing the latest emission factors presented in the *"State Inventory and Projection Tool"*[27] (SIT) and the *"Emissions & Generation Resource Integrated Database"*[28] (eGRID) developed by the United States Environmental Protection Agency (USEPA). Additionally, equivalency results to translate emissions measurements into relatable terms were calculated by utilizing the *"Greenhouse gas Equivalencies Calculator"*[29] developed by the USEPA.

Please note that prior to the December 1, 2021 report, the USI program historically applied one constant kilowatt-hour (kWh) emission factor for all fiscal years based on the most recent *"Emissions & Generation Resource Integrated Database"* (eGRID) data. However, it was later determined that this methodology was incorrect since the average generation mix changes over time for fossil fuel-fired electricity generating units. As such, the old methodology in addition to omitted chilled water and steam efficiency factors for the UNC System *(in previous reports)* significantly underestimated greenhouse gas emissions reductions.

Quality Assurance Measures

Staff from the Utility Savings Initiative (USI) program applied quality assurance measures to ensure that the data meets indicator goals and objectives. For example, all raw utility consumption data utilized to calculate avoided emissions were checked for reasonableness against historical data from the same data category and geographic area (i.e., county, city, or state). In addition, all automated calculations and data processing operations performed by spreadsheet macros and database queries were validated by comparing to hand-calculated results.

Methodology to Calculate Avoided Greenhouse Gas Emissions

To generate the emission calculation conversion factors Table 1, the USI program utilized the following methodology:

1) **Kilowatt hours (kWh):** Prior to last year's report, the USI program historically applied one constant kWh emission factor for all fiscal years based on eGRID data. However, it was later determined that this methodology was incorrect since the average generation mix changes over time for fossil fuel-fired electricity generating units. As such, the old methodology significantly underestimated greenhouse gas emissions reductions from the electricity sector.

   Based on these findings, the USI program utilized the following general formula to develop updated emission factors in for the electricity sector for each fiscal year:

   $$MTCO_{2e} \text{ per kWh by Year} = (\text{eGRID Emission Rate by Year (lb CO2e/kWh)}) / (2204.62 \text{ lb/metric ton})$$

[27] https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[28] https://www.epa.gov/egrid/download-data
[29] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Please note: 2005, 2007, 2009, 2010, 2012, 2014, 2016, 2018, 2019, and 2020 emission rate values *(lb/kWh)* were taken from eGRID data files released by the USEPA *(which is typically updated every two years)*. Based on these values, emission factors are interpolated for intermediate years *(i.e., (base + future year) / 2))* and held constant for the beginning and end of the time series *(i.e., 2002 through 2004; and 2021 through 2022).*

2) **Therms:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for natural gas:

Total CO_{2e} Emission Factor for Therms = *(((SIT Tool's $MTCO_{2e}$/Btu * 1.00E-05 therm/Btu conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) / (1,000,000,000 Btu/BBtu conversion factor) / (1.00E-05 therm/Btu conversion factor)) * (25 global warming potential factor for CH_4)) + (((SIT Tool's MTN_2O/BBtu) / (1,000,000,000 Btu/BBtu conversion factor) / (1.00E-05 therm/Btu conversion factor)) * (298 global warming potential factor for N_2O)))*

-Or Simply-

Total CO_{2e} Emission Factor for Therms = *($MTCO_{2e}$/therm for CO_2) + ($MTCO_{2e}$/therm for CH_4) + ($MTCO_{2e}$/therm for N_2O)*

Please note: The same emission factor for therms was applied to all fiscal years since emissions from natural gas were assumed to remain relatively constant over time.

3) **Number 2 Distillate Oil:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for distillate oil:

Total CO_{2e} Emission Factor for Number 2 Distillate Oil = *(((SIT Tool's $MTCO_{2e}$/Btu * 138,690 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (138,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (138,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Number 2 Distillate Oil = *($MTCO_{2e}$/gal distillate oil for CO_2) + ($MTCO_{2e}$/gal distillate oil for CH_4) + ($MTCO_{2e}$/gal distillate oil for N_2O)*

Please note: The same emission factor for fuel oil was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

4) **Number 6 Residual Oil:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for residual oil:

Total CO_{2e} Emission Factor for Number 6 Residual Oil = *(((SIT Tool's $MTCO_{2e}$/Btu * 149,690 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (149,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (149,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Number 6 Residual Oil = *($MTCO_{2e}$/gal residual oil for CO_2) + ($MTCO_{2e}$/gal residual oil for CH_4) + ($MTCO_{2e}$/gal residual oil for N_2O)*

Please note: The same emission factor for residual oil was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

5) **Propane:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for propane:

Total CO_{2e} Emission Factor for Propane = *(((SIT Tool's $MTCO_{2e}$/Btu * 91,648 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (91,648 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (91,648 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Propane = *($MTCO_{2e}$/gal propane for CO_2) + ($MTCO_{2e}$/gal propane for CH_4) + ($MTCO_{2e}$/gal propane for N_2O)*

Please note: The same emission factor for propane was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

Table B.1: Emission Calculation Conversion Factors

Fiscal Year	$MTCO_{2e}$/kWh	$MTCO_{2e}$/Therm	$MTCO_{2e}$/Gal 2 Oil	$MTCO_{2e}$/Gal 6 Oil	$MTCO_{2e}$/Gal Propane
2002-03	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2003-04	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2004-05	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2005-06	0.00055765	0.005318772	0.010317173	0.011304793	0.005706251
2006-07	0.000561424	0.005318772	0.010317173	0.011304793	0.005706251
2007-08	0.000554367	0.005318772	0.010317173	0.011304793	0.005706251
2008-09	0.000536479	0.005318772	0.010317173	0.011304793	0.005706251
2009-10	0.000533099	0.005318772	0.010317173	0.011304793	0.005706251
2010-11	0.000524392	0.005318772	0.010317173	0.011304793	0.005706251
2011-12	0.000495851	0.005318772	0.010317173	0.011304793	0.005706251
2012-13	0.000473062	0.005318772	0.010317173	0.011304793	0.005706251
2013-14	0.000456026	0.005318772	0.010317173	0.011304793	0.005706251
2014-15	0.000434589	0.005318772	0.010317173	0.011304793	0.005706251
2015-16	0.000408751	0.005318772	0.010317173	0.011304793	0.005706251
2016-17	0.000387544	0.005318772	0.010317173	0.011304793	0.005706251
2017-18	0.000370968	0.005318772	0.010317173	0.011304793	0.005706251
2018-19	0.000358137	0.005318772	0.010317173	0.011304793	0.005706251
2019-20	0.000323862	0.005318772	0.010317173	0.011304793	0.005706251
2020-21	0.00029413	0.005318772	0.010317173	0.011304793	0.005706251
2021-22	0.00029413	0.005318772	0.010317173	0.011304793	0.005706251

Table B.2: State Inventory and Projection Tool Emission Factors[30]

Fuel Type	Carbon Dioxide		Methane		Nitrous Oxide	
Natural Gas (Res/Comm)	5.30549E-08	MTCO2e/ Btu	0.00475	MTCH4/ BBtu	0.00009	MTN2O /BBtu
Natural Gas (Res/Comm)	5.30E-03	MTCO2e/ therm	1.19E-05	MTCO2e/ therm	2.68E-06	MTCO2 e/therm
No. 2 Fuel Oil (Res/comm)	7.39609E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
No. 2 Fuel Oil (Res/comm)	0.010257634	MTCO2e/ gal	3.47418E-05	MTCO2e/ gal	2.47978E-05	MTCO2 e/gal
No. 6 Dist Oil (Res/comm)	7.50918E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
No. 6 Dist Oil (Res/comm)	0.011240531	MTCO2e/ gal	3.74975E-05	MTCO2e/ gal	2.67647E-05	MTCO2 e/gal
Propane	6.18334E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
Propane	0.005666907	MTCO2e/ gal	2.29578E-05	MTCO2e/ gal	1.63867E-05	MTCO2 e/gal

[30] https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool

Collective Avoided Greenhouse Gas Emissions

By utilizing the methodology described in the previous section, Table 3 and Table 4 represent the avoided greenhouse gas emissions for state agencies and the UNC System (i.e., state-owned buildings). Table B.3 provides avoided greenhouse gas emissions since the FY2002-03 baseline. In addition, Table B.4 provides a snapshot of avoided greenhouse gas emissions data to show the program's effectiveness during the most recent fiscal year (FY2021-22).

Table B.3: FY2002-03 to FY2021-22 Avoided Greenhouse Gas Totals

Fuel Source Usage	Cabinet Agencies (MTCO2e)	Other Agencies (MTCO2e)	UNC System (MTCO2e)	All State Government Units (MTCO2e)
Electricity	2,095,699	70,489	5,296,581	**7,462,769**
Nat Gas	-148,564	18,709	-323,005	**-452,859**
Fuel Oil	616,448	502	1,418,870	**2,035,821**
Propane	62,980	2,579	5,770	**71,329**
Total	**2,626,563**	**92,280**	**6,398,216**	**9,117,060**

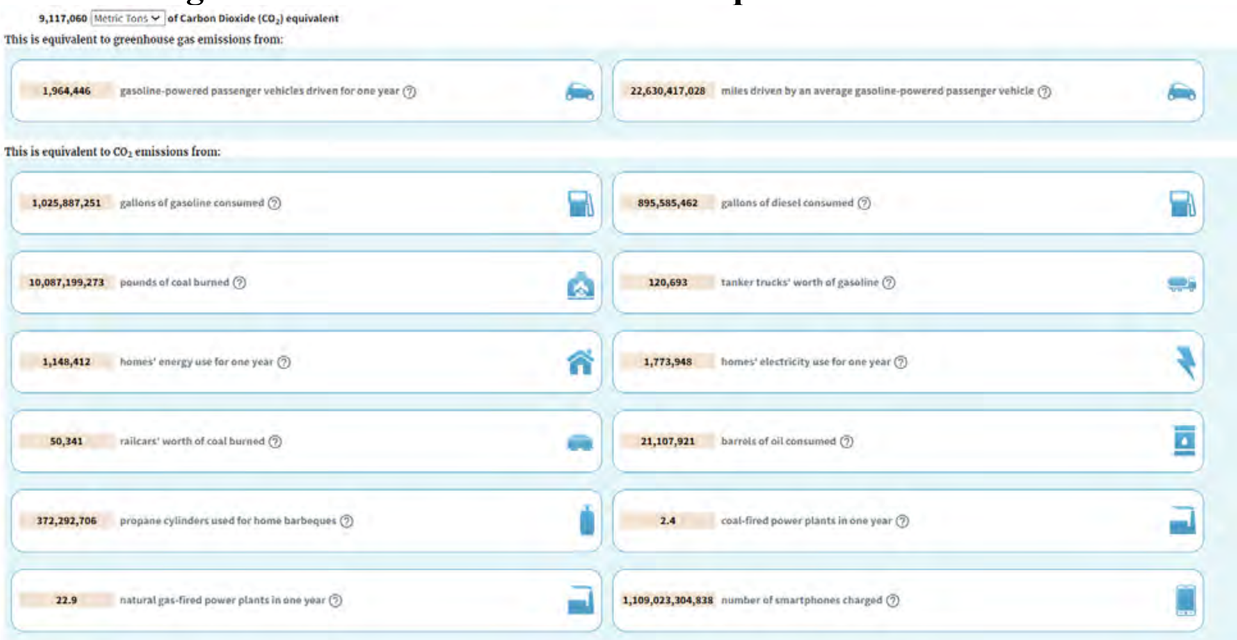
Table B.4: FY2021-22 Avoided Greenhouse Gas Totals

Fuel Source Usage	Cabinet Agencies (MTCO2e)	Other Agencies (MTCO2e)	UNC System (MTCO2e)	All State Government Units (MTCO2e)
Electricity	254,411	11,864	671,831	**938,107**
Nat Gas	9,317	1,367	-36,237	**-25,553**
Fuel Oil	37,992	-334	91,462	**129,120**
Propane	10,686	368	639	**11,693**
Total	**312,406**	**13,265**	**727,696**	**1,053,366**

Greenhouse Gas Equivalencies

Figure 1 contains a screenshot of the USEPA's greenhouse gas equivalencies calculator[31] based on total avoided emissions since the 2002-03 baseline for state-owned buildings. As shown, the figure provides relatable terms for the program's environmental success.

Figure B.1: EPA Greenhouse Gas Equivalencies Calculator



[31] *EPA Greenhouse Gas Equivalencies Calculator;* https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Appendix C

Utility Management Plans

Appendix C Table of Contents:

Utility Management Plan Submissions

NORTH CAROLINA
DEPARTMENT OF ADMINISTRATION
ENERGY USAGE REPORT 2019-20

Prepared By: Design & Consulting Services Section
State Construction Office

PURPOSE

The Department of Administration (DOA) reports energy and water usage annually and includes the figures in the Energy Management Plan. Reporting originally was done annually in accordance with the requirements of GS 143-64.12. It also addresses reporting requirements of EO-80, dated October 29, 2018. The baseline year is FY 2002-03.

OVERVIEW

For last year's report, DOA, in response to requests from DEQ, reviewed and revised the Gross Square Footage (GSF) figures used for energy reporting. DOA is assigned most of the State buildings in the Raleigh Downtown Government Campus and DOA Facility Management is responsible for operating and maintaining these buildings, including paying the water, electric, and natural gas utility bills. DOA operates a central steam heating plant, two chilled water plants, and chilled water storage tanks. These plants provide chilled water and steam to many of the DOA buildings and a few buildings that are being reported to the Energy Office by other state agencies. This report continues to focus primarily on the Downtown Complex, using the baseline revised for the 2018-19 report.

Revised baseline: Previous reporting included additional buildings. The table below shows the revised baseline. For additional information, refer to notes on DOA energy reporting; parking decks; and, buildings.

FY	Energy + Water Cost ($)	Total Energy Cost ($)	Total Energy Usage (Btu)	Total Water + Sewer Cost ($)	Total water Usage (mgal)	Total Building Area (gsf)	Energy Tracking Measure (Btu/gsf)	Energy Reduction from Baseline (%)
2002-03	$8,621,411	$8,621,411	696,827,809,264	Not Available	Not Available	4,659,040	149,565	NA
Revised 2002-03	$7,894,926	$7,894,926	473,446,975,544	Not Available	Not Available	3,653,063	129,603	NA

CURRENT ENERGY PERFORMANCE

The table below identifies the DOA baseline energy usage of 2002-03 (revised) and the present energy usage for 2018-19, and 2019-20.

FY	Energy + Water Cost ($)	Total Energy Cost ($)	Total Energy Usage (Btu)	Total Water + Sewer Cost ($)	Total water Usage (mgal)	Total Building Area (gsf)	Energy Tracking Measure (Btu/gsf)	Energy Reduction from Baseline (%)
Revised 2002-03	$7,894,926	$7,894,926	473,446,975,544	Not Available	Not Available	3,653,063	129,603	NA
2018-19	$7,559,514	$7,060,624	460,262,263,776	$498,890	39,611	4,084,314	112,718	-13.0%
2019-20	$6,553,802	$6,024,098	446,307,164,846	$529,704	45,140	4,084,314	109,273	-15.7%

Based upon baseline data reported in FY2002-03, DOA is reporting an Energy Reduction of 15.7%. Water reporting has been erratic and as such, the baseline was not reported. DOA did report water usage for FY 2018-19 and FY2019-20.

DOA Energy Reporting:

The Baseline and subsequent reporting of energy data has been dependent in large part on a database and reporting tool that is fraught with errors. The database tool includes report generation that is now known to generate reports that include corrupted data. Some reports drop individual monthly data that is contained in the database. The database was originally designed as a DOS-based system and does not meet the current IT standards. DOA will not renew the contract for this system. A task group is reviewing options for a replacement that meeting IT standards and provides accurate reporting capabilities. This energy usage report is based on energy billing and usage data available, with acknowledgement that it contains incomplete data due to the limitations of the energy database tool in use.

Parking Decks:

In 2018 and 2019, DEQ questioned the square footage reported by DOA. In large part, the question was the inclusion of parking decks in the energy reporting. In 2019, efforts were made to reconcile the square footage and baseline figures. Parking deck square footage is not included in the energy usage reporting.

Parking Deck 65 is attached to five (5) Downtown Government Complex buildings: Archdale Building; Dobbs Building; New Revenue Building; New Education Building; and Legislative Office Building (LOB). Parking Deck 65 does not have its own electrical service or electrical meter. It was built in phases, as the buildings around Halifax Mall were built. There is no practical way to segregate the electrical usage of the parking deck from the surrounding buildings. The parking deck energy usage includes lighting and exhaust fans for ventilation. In addition, automatic roll-up doors add to the electrical load.

Parking Deck 77 was built as part of the Green Square project. The square footage increased with the addition of Nature Resource Center (NRC), DENR/DEQ Office Building, and Parking Deck 77. An effort has been made to be more transparent about the buildings and square footage included in the report.

Parking Deck 17 sits below the Museum of History. Notes on the energy reporting template indicated that Museum of History included 301,000 GSF for parking deck. The Museum of History is being reported as 190,099 GSF, as reflected in the State Property Office (SPO) database. This does not include additional square footage for Parking Deck 17.

The billing and meter data is stored in a database that has a web interface for extracting or reporting data. The software package, Willowtec, was one of the early tools used in State Government for energy reporting. In 2001-02 it was considered by some ahead of its time; however, it falls short of meeting even its initial intent. The constraints associated with the program are clear indications it is not adequate for the energy management needs of DOA. Review of the data in the database reveal that it contains some discrepancies. DOA is researching other options that are better suited to meet its utility metering and billing data management and reporting needs. Available options can help DOA make better use of the data as a management tool, as well as providing a tool for reporting to meet the reporting requirements of EO-80. Available information indicates that DOA is opted-in for the energy efficiency rider charged by the electric utility, without making full use of the energy efficiency resources funded by this rider. DOA is exploring other energy data management tools. Opting out of the energy efficiency rider may provide some funding to go toward the new energy data tool.

Buildings included in the Willowtec database include buildings that are not DOA buildings. Efforts were made to reconcile GSF figures, as well as identify the groups of buildings that are included. The SPO data was used to identify buildings, agency, square footage, and construction year.

Buildings (Background and Notes):

The revised baseline includes only the DOA owned and operated buildings in the Downtown Government Complex.

Legislative Building (LB) and Legislative Office Building (LOB) do not fall under DOA and are not included in the DOA square footage. The steam and chilled water supplied to LB and LOB are included in the energy report. Steam and chilled water supplied by the central plants to LB and LOB have not been separately metered. SPO lists the size of the buildings as 165,786 GSF and 166,144 GSF, respectively.

Highway Building, Former Art Museum, and Olivia Raney Building, all located in downtown Raleigh, are Department of Transportation (DOT) maintained and operated, and are not included in the DOA reporting.

Department of Military and Veteran Affairs (DMVA) is now a separate department. Prior to being named a department, it was a division within DOA. Currently the only building that falls under DOA is the Seaboard Building, owned and operated by DOA, and occupied by DMVA.

Garner Road Complex – Department of Public Safety – State Highway Patrol – Garner Road.

Motor Fleet and Textbook Warehouse are outside of the Downtown Government Complex. These buildings are located on Blue Ridge Road.

Federal Surplus – The Federal Surplus Warehouse is listed by the SPO database as a total of 70,418 GSF. It is not included in the DOA Downtown Government Complex and is not included in the report.

State Surplus Warehouse is listed by the SPO database as 41,164 GSF. It is not included in the DOA Downtown Government Complex and is not included in the report.

North Carolina Museum of Art – Located on Blue Ridge Road and listed by SPO as Department of Natural and Cultural Resources (DNCR).

State Public Health Lab, constructed 2012, is a Department of Health and Human Services (DHHS) building.

State Crime Lab - Listed by SPO as Attorney General-Justice.

For Natural Gas cost and usage, the database does not include complete information. Several of the smaller buildings have cost data, but do not quantify units of natural gas consumption in therms. Estimates were calculated to express energy in therms, so as to be able to report total btus.

North Carolina
Department of Commerce
Division of Employment Security

<u>Utility Management Plan</u>

March, 2021

Utility Management Plan

Contents

Executive Summary

Introduction

The Utility Management Plan began development as the Strategic Energy Plan. The Strategic Energy Plan was originally developed in accordance with General Statutes 143-64.12 (b) to support statewide efforts in improving the energy efficiency of state-owned facilities (see Appendix 1). The Strategic Energy Plan has been superseded by the Utility Management Plan in accordance with Executive Order 80.

The DES Central Office, at 700 Wade Avenue, is comprised of 246,039 square feet of space (interior gross) and nine wings. The utility plant consists of two steam boilers (150 horsepower each), and two chillers (350 tons each). This equipment provides comfort cooling and heating only. The facility provides approximately 400 persons general office space usually between 6 AM and 7 PM, five days per week. DES owns the Central Office space and leases nearly 27,913 square footage of office space in 2 locations in Raleigh and Charlotte.

This Plan encompasses five focus areas; Utility Accounting, Procurement Management, Building Energy Use, Equipment Efficiency and Organization Integration. The Plan is built around seven sections:

1) Baseline Energy Use 2002/2003 (benchmarking)
2) Planned Actions and Projects
3) Savings Opportunity Assessment

4) Financial Assessment
5) Goals and Measures
6) Budgeting
7) The Energy Mandate

This Plan will be updated and submitted on a biennial basis to the Department of Environmental Quality.

1. Baseline Energy Use

The Executive Order 80 established the calendar year 2002-2003 as the baseline for its energy program as a starting point from which to measure improvement. The measure consists of a cost of $1.53/sf, and a consumption rate of 105.5 kBTU/sf (see appendix 2). The DES Central Office measurements currently use a square footage of 261,091 (gross interior) sq. ft.

Appendix number 2 contains a break down by energy source of the usage and cost data per square foot for the campus.

2. Planned actions and Projects

The Division of Employment Security Wade Avenue Central Office has been deemed surplus by the NC Department of Administration. This has significantly affected the overall objective and dynamics of the DES Utility Management Plan. Planned actions and projects must have the intent and goal of final compliance with Executive Order 80 while remaining fiscally responsible in respect to taxpayer funding and the future of the 700 Wade Avenue complex. A consolidated, comprehensive Utility Management Plan is attached in Appendix 3

A. Plans

Energy Data Management: The Support Services Division established Excel spreadsheets for collecting and analyzing the monthly energy billing information. The energy monitor reviews the data with the Division Director to identify and analyze excessive variations and to target areas for follow-up studies.

Energy Use in Facilities: Through attrition and project funding DES will continue to replace or modify existing systems with more modern energy efficient equipment. This effectively will reduce resource consumption throughout the facility.

Equipment Efficiency: The maintenance staff operates under a robust preventative maintenance program that ensures efficient operation of our physical plant and air handlers throughout the facility. The staff walks the campus several times per day to keep close tabs on any mechanical failures. The automated controls assist in monitoring the entire site system. In addition, DES conducts annual boiler and chiller/cooling tower tune-ups to maintain efficiency.

Organization Integration: The Assistant Secretary assigned day-to-day responsibility for the energy management program to the Director of Support Services. Support Services staff monitors energy consumption and costs and provides the resources to maintain the equipment.

DES compiled, reviewed, and incorporated suggestions and information from several sources (power company survey, State Construction survey, Department of Environmental Quality, and others) to determine improvement actions. The assessment process identified actions that if put into place could improve the DES energy conservation performance. In the Utility Management Plan, these actions are addressed under the following sections.

Process Improvement
Program Implementation
Savings Estimate & Financial Evaluation
Projects

Process Improvement:

A comprehensive continuous review of policies and procedures by the Energy Manager and staff to ensure procedures include energy efficiency best practices.
Assigned to: Energy Manager Continuous

Continue to improve the operation of the HVAC system through improved controls and assessments by outside consultants.
Assigned to: Support Services Director Continuous

Continued scheduling maintenance of facility related equipment, i.e. boilers, chillers, and air handlers during off peak hours only.
Assigned to: Support Services Director Continuous

Program Implementation:

Seek out and provide training opportunities for the maintenance staff to maintain proficiency in operations and to keep abreast of new technologies.
Assigned to: Support Services Director Continuous

3. Savings Estimate & Financial Evaluation:

The Support Services Division is always looking for better ways to enhance our energy conservation program, while evaluating further potential savings and financial impacts. Utility bills are reviewed monthly to evaluate the overall results of energy saving initiatives.

Projects

Due to pending sale of the facility, no major capital improvement projects are scheduled at this time.
Low cost and no cost conservation strategies are in constant development and deployment throughout the facility.

Section 4: Financial Assessment

DES works closely with architects and engineers in developing alternatives to improving our infrastructure. Additionally, DES works with the State Construction Office on the best method in which to execute these projects. Finally, DES works closely with our Finance and Budget office to determine the most prudent time to accomplish any improvements based on availability of funds and payback assessments. Where applicable and feasible a return on investment calculation is prepared to better evaluate cost. The 700 Wade Avenue Facility has been identified as surplus property and will be sold after a new facility is appropriated for the agency. Any capital expenditures must be fiscally responsible in accordance with the pending relocation.

Section 5: Goals and Measures

DES's primary goal of the Utility Management Plan is to reduce per square foot energy usage by 40% by 2025

The measurement system uses the following criteria to meet the Utility Management Plan goal:

- Total utility consumption (power, gas) per square foot
- Initial investment versus cost avoidance
- Guarantee of continued service to customer

Section 6: Budget

DES uses Federal grant funds to accomplish facility improvements. We look at cost effectiveness, as well as, need to assess the best use of the taxpayer's money.

Section 7: Mandate for Energy Management

Energy and energy management must be recognized as a controllable operating expense where in savings can result in funding being available for other program needs. If the energy management program is to be successful, all members of the DES staff have important roles to play. Energy cost reduction must become a vital part of the DES Utility Management Plan.

As an integral part of this Energy Strategic Plan, the DES established an Energy Mandate (see appendix 4).

Appendices

1. Utilities Spreadsheet: 2000-2020
2. Utility Management Plan
3. General Statutes Article 3B
4. Energy Mandate

Appendix 1
Utility Data

year	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $
1999-00	$508,025	$508,025	35,440,912,128	7,113,544	$431,916	111,695	$76,109
2000-01	$524,460	$524,460	34,635,978,166	6,687,596	$412,934	118,179	$111,527
2001-02	$384,142	$384,142	24,180,259,756	5,040,463	$337,212	69,822	$46,930
2002-03	$398,568	$398,568	27,553,553,592	5,420,766	$307,227	90,579	$91,341
2003-04	$385,680	$385,680	26,426,656,940	5,239,495	$306,706	85,495	$78,974
2004-05	$401,969	$401,969	25,442,300,480	5,072,040	$308,006	81,365	$93,964
2005-06	$399,623	$399,623	25,959,720,804	5,066,917	$319,663	86,714	$79,960
2006-07	$579,893	$526,987	26,259,454,380	5,138,615	$428,218	87,265	$98,769
2007-08	$439,222	$391,104	25,857,586,476	5,059,023	$312,644	85,962	$78,460
2008-09	$439,883	$408,319	24,321,665,000	4,451,250	$308,522	91,340	$99,797
2009-10	$492,919	$461,355	26,995,824,000	5,127,000	$385,828	95,025	$75,527
2010-11	$437,027	$405,463	27,941,797,364	5,382,297	$405,435	95,774	$64,033
2011-12	$429,622	$429,622	30,253,357,000	6,042,250	$429,622	96,372	$64,359
2012-13	$522,432	$473,597	32,012,825,000	5,806,250	$398,605	122,019	$74,992
2013-14	$408,615	$363,840	26,780,142,000	4,303,500	$277,855	120,966	$85,985
2014-15	$513,753	$466,425	33,523,071,000	5,951,750	$380,477	132,157	$85,948
2015-16	$477,533	$446,724	30,614,821,000	5,264,250	$380,651	126,532	$66,073
2016-17	$467,705	$419,353	30,222,011,940	5,123,245	$356,326	127,415	$63,027
2017-18	$492,371	$434,168	34,489,422,000	5,193,500	$349,669	167,692	$84,499
2018-19	$554,730	$508,887	36,034,543,920	5,141,660	$407,563	184,912	$101,324
2019-20	$334,274	$314,219	25,434,021,000	3,539,250	$251,188	133,581	$63,103

Fiscal year	energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal
1999-00		$1.95	$14.334		135,742			$0.00
2000-01	$12,188	$2.01	$15.142	6%	132,659	-2%	$0	$0.00
2001-02	$178,893	$1.47	$15.887	11%	92,612	-32%	$0	$0.00
2002-03	$114,092	$1.53	$14.465	1%	105,532	-22%	$0	$0.00
2003-04	$131,557	$1.48	$14.594	2%	101,216	-25%	$0	$0.00
2004-05	$157,970	$1.54	$15.799	10%	97,446	-28%	$0	$0.00
2005-06	$145,953	$1.53	$15.394	7%	99,428	-27%	$0	$0.00
2006-07	$184,258	$2.02	$20.068	40%	100,576	-26%	-$52,906	$5.00
2007-08	$144,951	$1.38	$15.125	6%	99,037	-27%	-$48,118	$10.00
2008-09	$186,673	$1.56	$16.788	17%	93,154	-31%	-$31,564	$5.12
2009-10	$144,326	$1.77	$17.090	19%	103,396	-24%	-$31,564	$5.12
2010-11	$108,821	$1.55	$14.511	1%	107,019	-21%	-$31,564	$5.12
2011-12	$73,667	$1.65	$14.201	-1%	115,873	-15%	-$31,564	$5.12
2012-13	$50,715	$1.81	$14.794	3%	122,612	-10%	-$48,835	$8.05
2013-14	$117,667	$1.39	$13.586	-5%	102,570	-24%	-$44,776	$7.37
2014-15	$26,684	$1.79	$13.914	-3%	128,396	-5%	-$47,328	$14.12
2015-16	$70,421	$1.71	$14.592	2%	117,257	-14%	-$30,809	$23.61
2016-17	$72,416	$1.61	$13.876	-3%	115,753	-15%	-$48,352	$16.86
2017-18	$11,978	$1.66	$12.588	-12%	138,015	-3%	-$45,843	$15.72
2018-19	-$8,383	$1.95	$14.122	-1%	138,015	2%	-$45,843	$20.01
2019-20	$123,656	$1.20	$12.357	-14%	97,414	-28%	-$19,983	$951,.57

Appendix 2
Utility Management Plan

2020-21

Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect EE strategy toward 40% reduction in Btu/gsf.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2020-21 Planned Activities	**Expected Measurement**	**Assigned To**	**Occurrence**
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Monthly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager and staff	October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	(add dates of training)
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager and staff	
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager and staff	
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager	Quarterly
Track utility data	Collect annual utility data submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year

2020-21

Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Determine cost feasibility of projects
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	**Expected Measurement**	**Assigned To**	**Occurrence**
Continual Lighting Retrofit	32 watt T8 replaced with 13 watt LED	Maintenance Staff	continuous
Meet with automation vendor to investigate low no cost changes to improve efficiency	Automated energy conservation measures	Energy Manager	June, 2021
Adjust policies and post order to include energy conservation best practices	Disseminate information on new procedures to staff for added efficiency while ensuring continuity of building services during working hours.	Energy Manager and Agency Staff	Continuous
HVAC systems optimization.	Dynamic adjustment of setpoints to match ambient temperatures. Savings dependent on amount of heating and cooling degree days.	Maintenance Staff	Continuous
Low cost conservation equipment solutions	Implement low cost energy conservation equipment.	Energy Manager	Continuous
Replace Kewanee boiler burner with efficient low turn down model	Waiting on data	Energy Manager	April 2021

Appendix 3

Article 3B.

Conservation of Energy, Water, and Other Utilities in Government Facilities.

Part 1. Energy Policy and Life-Cycle Cost Analysis.

§ 143-64.10. Findings; policy.

(a) The General Assembly finds all of the following:

(1) That the State shall take a leadership role in aggressively undertaking the conservation of energy, water, and other utilities in North Carolina.

(2) That State facilities and facilities of State institutions of higher learning have a significant impact on the State's consumption of energy, water, and other utilities.

(3) That practices to conserve energy, water, and other utilities that are adopted for the design, construction, operation, maintenance, and renovation of these facilities and for the purchase, operation, and maintenance of equipment for these facilities will have a beneficial effect on the State's overall supply of energy, water, and other utilities.

(4) That the cost of the energy, water, and other utilities consumed by these facilities and the equipment for these facilities over the life of the facilities shall be considered, in addition to the initial cost.

(5) That the cost of energy, water, and other utilities is significant and facility designs shall take into consideration the total life-cycle cost, including the initial construction cost, and the cost, over the economic life of the facility, of the energy, water, and other utilities consumed, and of operation and maintenance of the facility as it affects the consumption of energy, water, or other utilities.

(6) That State government shall undertake a program to reduce the use of energy, water, and other utilities in State facilities and facilities of the State institutions of higher learning and equipment in those facilities in order to provide its citizens with an example of energy-use, water-use, and utility-use efficiency.

(b) It is the policy of the State of North Carolina to ensure that practices to conserve energy, water, and other utilities are employed in the design, construction, operation, maintenance, and renovation of State facilities and facilities of the State institutions of higher learning and in the purchase, operation, and maintenance of equipment for these facilities. (1975, c. 434, s. 1; 1993, c. 334, s. 2; 2001-415, s. 1; 2006-190, s. 8; 2007-546, s. 3.1(b).)

<u>§ 143-64.11. Definitions.</u>

For purposes of this Article:

(1) "Economic life" means the projected or anticipated useful life of a facility.

(2) "Energy-consumption analysis" means the evaluation of all energy- consuming systems, including systems that consume water or other utilities, and components of these systems by demand and type of energy or other utility use, including the internal energy load imposed on a facility by its occupants, equipment and components, and the external energy load imposed on the facility by climatic conditions.

(2a) "Energy Office" means the State Energy Office of the Department of Environmental Quality.
(2b) "Energy-consuming system" includes but is not limited to any of the following equipment or measures:

a. Equipment used to heat, cool, or ventilate the facility;
b. Equipment used to heat water in the facility;
c. Lighting systems;
d. On-site equipment used to generate electricity for the facility;
e. On-site equipment that uses the sun, wind, oil, natural gas, liquid propane gas, coal, or electricity as a power source; and
f. Energy conservation measures, as defined in G.S. 143-64.17, in the facility design and construction that decrease the energy, water, or other utility requirements of the facility.

(3) "Facility" means a building or a group of buildings served by a central distribution system for energy, water, or other utility or components of a central distribution system.
(4) "Initial cost" means the required cost necessary to construct or renovate a facility.
(5) "Life-cycle cost analysis" means an analytical technique that considers certain costs of owning, using, and operating a facility over its economic life, including but not limited to:
a. Initial costs;
b. System repair and replacement costs;
c. Maintenance costs;
d. Operating costs, including energy costs; and
e. Salvage value.
(6) Repealed by Session Laws 1993, c. 334, s. 3, effective July 13, 1993.
(7) "State agency" means the State of North Carolina or any board, bureau, commission, department, institution, or agency of the State.
(8) "State-assisted facility" means a facility constructed or renovated in whole or in part with State funds or with funds guaranteed or insured by a State agency.
(9) "State facility" means a facility constructed or renovated, by a State agency.
(10) "State institution of higher learning" means any constituent institution of The University of North Carolina. (1975, c. 434, s. 2; 1989, c. 23, s. 1; 1993, c. 334, s. 3; 2001-415, s. 2; 2006-190, ss. 9, 10, 11; 2007-546, s. 3.1(c); 2009-446, s. 1(f); 2013-360, s. 15.22(o); 2015-241, s. 14.30(u).)

§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually.

Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office a biennial written report of utility consumption and costs. Management plans submitted biennially by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.
(2) The cost of analyzing the projected energy savings.
(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.
(4) An analysis that identifies projected annual energy savings and estimated payback periods.

(a1) State agencies and State institutions of higher learning shall carry out the construction and renovation of facilities in such a manner as to further the policy set forth under this section and to ensure the use of life-cycle cost analyses and practices to conserve energy, water, and other utilities.

(b) The Department of Administration shall develop and implement policies, procedures, and standards to ensure that State purchasing practices improve efficiency regarding energy, water, and other utility use and take the cost of the product over the economic life of the product into consideration. The Department of Administration shall adopt and implement Building Energy Design Guidelines. These guidelines shall include energy-use goals and standards, economic assumptions for life-cycle cost analysis, and other criteria on building systems and technologies. The Department of Administration shall modify the design criteria for construction and renovation of facilities of State buildings and State institutions of higher learning buildings to require that a life-cycle cost analysis be conducted pursuant to G.S. 143-64.15.

(b1) The Department of Administration, as part of the Facilities Condition and Assessment Program, shall identify and recommend energy conservation maintenance and operating procedures that are designed to reduce energy consumption within the facility of a State agency or a State institution of higher learning and that require no significant expenditure of funds. Every State agency or State institution of higher learning shall implement these recommendations. Where energy management equipment is proposed for any facility of a State agency or of a State institution of higher learning, the maximum interchangeability and compatibility of equipment components shall be required. As part of the Facilities Condition and Assessment Program under this section, the Department of

Administration, in consultation with the State Energy Office, shall develop an energy audit and a procedure for conducting energy audits. Every five years the Department shall conduct an energy audit for each State agency or State institution of higher learning, and the energy audits conducted shall serve as a preliminary energy survey. The State Energy Office shall be responsible for system-level detailed surveys.

(b2) The Department of Administration shall submit a report of the energy audit required by subsection (b1) of this section to the affected State agency or State institution of higher learning and to the State Energy Office. The State Energy Office shall review each audit and, in consultation with the affected State agency or State institution of higher learning, incorporate the audit findings and recommendations into the management plan required by subsection (a) of this section.

(c) through (g) Repealed by Session Laws 1993, c. 334, s. 4.

(h) When conducting a facilities condition and assessment under this section, the Department of Administration shall identify and recommend to the State Energy Office any facility of a State agency or State institution of higher learning as suitable for building commissioning to reduce energy consumption within the facility or as suitable for installing an energy savings measure pursuant to a guaranteed energy savings contract under Part 2 of this Article.

(i) Consistent with G.S. 150B-2(8a)h., the Department of Administration may adopt architectural and engineering standards to implement this section.

(j) The State Energy Office shall submit a report by December 1 of every odd-numbered year to the Joint Legislative Energy Policy Commission, the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division describing the comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning required by subsection (a) of this section. The report shall also contain the following:

(1) A comprehensive overview of how State agencies and State institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains.

(2) Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed.

(3) A summary of the State agency and State institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section.

(4) A list of the State agencies and State institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the State agencies and State institutions of higher learning that received an energy audit.

(5) Any recommendations on how management plans can be better managed and implemented. (1975, c. 434, s. 3; 1993, c. 334, s. 4; 2000-140, s. 76(f); 2001-415, s. 3; 2006-190, s. 12; 2007-546, s. 3.1(a); 2008-198, s.

11.1; 2009-446, s. 1(e); 2010-31, s. 14.3; 2010-196, s. 2; 2013-360, s. 15.22(p); 2014-120, s. 55; 2015-241, s. 14.30(u); 2017-57, s. 14.1(f).)

§ 143-64.13: Repealed by Session Laws 1993, c. 334, s. 5.

§ 143-64.14: Recodified as § 143-64.16 by Session Laws 1993, c. 334, s. 7.

§ 143-64.15. Life-cycle cost analysis.

(a) A life-cycle cost analysis shall be commenced at the schematic design phase of the construction or renovation project, shall be updated or amended as needed at the design development phase, and shall be updated or amended again as needed at the construction document phase. A life-cycle cost analysis shall include, but not be limited to, all of the following elements:

(1) The coordination, orientation, and positioning of the facility on its physical site.
(2) The amount and type of fenestration and the potential for daylighting employed in the facility.
(3) Thermal characteristics of materials and the amount of insulation incorporated into the facility design.
(4) The variable occupancy and operating conditions of the facility, including illumination levels.
(5) Architectural features that affect the consumption of energy, water, and other utilities.

(b) The life-cycle cost analysis performed for any State facility shall, in addition to the requirements set forth in subsection (a) of this section, include, but not be limited to, all of the following:

(1) An energy-consumption analysis of the facility's energy-consuming systems in accordance with the provisions of subsection (g) of this section.
(2) The initial estimated cost of each energy-consuming system being compared and evaluated.
(3) The estimated annual operating cost of all utility requirements.
(4) The estimated annual cost of maintaining each energy-consuming system.
(5) The average estimated replacement cost for each system expressed in annual terms for the economic life of the facility.

(c) Each entity shall conduct a life-cycle cost analysis pursuant to this section for the construction or the renovation of any State facility or State-assisted facility of 20,000 or more gross square feet. For the replacement of heating, ventilation, and air-conditioning equipment in any State facility or State-assisted facility of 20,000 or more gross square feet, the entity shall conduct a life-cycle cost analysis of the replacement equipment pursuant to this section when the replacement is financed under a guaranteed energy savings contract or financed using repair and renovation funds.

(d) The life-cycle cost analysis shall be certified by a registered professional engineer or bear the seal of a North Carolina registered architect, or both. The engineer or architect shall be particularly qualified by training and experience for the type of work involved, but shall not be employed directly or indirectly by a fuel provider, utility company, or group supported by fuel providers or utility funds. Plans and specifications for facilities involving public funds shall be designed in conformance with the provisions of G.S. 133-1.1.

(e) In order to protect the integrity of historic buildings, no provision of this Article shall be interpreted to require the implementation of measures to conserve energy, water, or other utility use that conflict with respect to any property eligible for, nominated to, or entered on the National Register of Historic Places, pursuant to the National Historic Preservation Act of 1966, P.L. 89-665; any historic building located within an historic district as provided in Chapters 160A or 153A of the General Statutes; any historic building listed, owned, or under the jurisdiction of an historic properties commission as provided in Chapter 160A or 153A; nor any historic property owned by the State or assisted by the State.

(f) Each State agency shall use the life-cycle cost analysis over the economic life of the facility in selecting the optimum system or combination of systems to be incorporated into the design of the facility.

(g) The energy-consumption analysis of the operation of energy-consuming systems utilities in a facility shall include, but not be limited to, all of the following:

(1) The comparison of two or more system alternatives.
(2) The simulation or engineering evaluation of each system over the entire range of operation of the facility for a year's operating period.
(3) The engineering evaluation of the consumption of energy, water, and other utilities of component equipment in each system considering the operation of such components at other than full or rated outputs. (1993, c. 334, s. 6; 2001-415, ss. 4, 5; 2006-190, s. 13; 2007-546, s. 4.1.)

§ 143-64.15A. Certification of life-cycle cost analysis.

Each State agency and each State institution of higher learning performing a life-cycle cost analysis for the purpose of constructing or renovating any facility shall, prior to selecting a design option or advertising for bids for construction, submit the life-cycle cost analysis to the Department for certification at the schematic design phase and again when it is updated or amended as needed in accordance with G.S. 143-64.15. The Department shall review the material submitted by the State agency or State institution of higher learning, reserve the right to require an agency or institution to complete additional analysis to comply with certification, perform any additional analysis, as necessary, to comply with G.S. 143-341(11), and require that all construction or renovation conducted by the State agency or State institution of higher learning comply with the certification issued by the Department. (2001-415, s. 6; 2007-546, s. 4.2.)

§ 143-64.16. Application of Part.

The provisions of this Part shall not apply to municipalities or counties, nor to any agency or department of any municipality or county; provided, however, this Part shall apply to any board of a community college. Community college is defined in G.S. 115D-2(2). (1975, c. 434, s. 5; 1989, c. 23, s. 2; 1993, c. 334, s. 7; 1993 (Reg. Sess., 1994), c. 775, s. 2.)

Part 2. Energy Saving Measures for Governmental Units.

§ 143-64.17. Definitions.

As used in this Part:

(1) "Energy conservation measure" means a facility or meter alteration, training, or services related to the operation of the facility or meter, when the alteration, training, or services provide anticipated energy savings or

capture lost revenue. Energy conservation measure includes any of the following:

a. Insulation of the building structure and systems within the building.

b. Storm windows or doors, caulking, weatherstripping, multiglazed windows or doors, heat-absorbing or heat-reflective glazed or coated window or door systems, additional glazing, reductions in glass area, or other window or door system modifications that reduce energy consumption.

c. Automatic energy control systems.

d. Heating, ventilating, or air-conditioning system modifications or replacements.

e. Replacement or modification of lighting fixtures to increase the energy efficiency of a lighting system without increasing the overall illumination of a facility, unless an increase in illumination is necessary to conform to the applicable State or local building code or is required by the light system after the proposed modifications are made.

f. Energy recovery systems.

g. Cogeneration systems that produce steam or forms of energy such as heat, as well as electricity, for use primarily within a building or complex of buildings.

h. Repealed by Session Laws 2006-190, s. 2, effective August 3, 2006, and applicable to contracts entered into or renewed on or after that date.

i. Faucets with automatic or metered shut-off valves, leak detection equipment, water meters, water recycling equipment, and wastewater recovery systems.

j. Other energy conservation measures that conserve energy, water, or other utilities.

(2) "Energy savings" means a measured reduction in fuel costs, energy costs, water costs, stormwater fees, other utility costs, or operating costs, including environmental discharge fees, water and sewer maintenance fees, and increased meter accuracy, created from the implementation of one or more energy conservation measures when compared with an established baseline of previous costs, including captured lost revenues, developed by the governmental unit.

(2a) "Governmental unit" means either a local governmental unit or a State governmental unit.

(3) "Guaranteed energy savings contract" means a contract for the evaluation, recommendation, or implementation of energy conservation measures, including the design and installation of equipment or the repair or replacement of existing equipment or meters, in which all payments, except obligations on termination of the contract before its expiration, are to be made over time, and in which energy savings are guaranteed to exceed costs.

(4) "Local governmental unit" means any board or governing body of a political subdivision of the State, including any board of a community

college, any school board, or an agency, commission, or authority of a political subdivision of the State.

(5) "Qualified provider" means a person or business experienced in the design, implementation, and installation of energy conservation measures who has been prequalified by the State Energy Office according to the prequalification criteria established by that Office.

(5a) "Qualified reviewer" means an architect or engineer who is (i) licensed in this State and (ii) experienced in the design, implementation, and installation of energy efficiency measures.

(6) "Request for proposals" means a negotiated procurement initiated by a governmental unit by way of a published notice that includes the following:

a. The name and address of the governmental unit.
b. The name, address, title, and telephone number of a contact person in the governmental unit.
c. Notice indicating that the governmental unit is requesting qualified providers to propose energy conservation measures through a guaranteed energy savings contract.
d. The date, time, and place where proposals must be received.
e. The evaluation criteria for assessing the proposals.
f. A statement reserving the right of the governmental unit to reject any or all the proposals.
g. Any other stipulations and clarifications the governmental unit may require.

(7) "State governmental unit" means the State or a department, an agency, a board, or a commission of the State, including the Board of Governors of The University of North Carolina and its constituent institutions. (1993 (Reg. Sess., 1994), c. 775, s. 3; 1995, c. 295, s. 1; 1999-235, ss. 1, 2; 2002-161, s. 2; 2006-190, s. 2; 2013-396, s. 1.)

§ 143-64.17A. Solicitation of guaranteed energy savings contracts.

(a) RFP Issuance. – Before entering into a guaranteed energy savings contract, a governmental unit shall issue a request for proposals. Notice of the request shall be published at least 15 days in advance of the time specified for opening of the proposals in at least one newspaper of general circulation in the geographic area for which the local governmental unit is responsible or, in the case of a State governmental unit, in which the facility or facilities are located. No guaranteed energy savings contract shall be awarded by any governmental unit unless at least two proposals have been received from qualified providers. Provided that if after the publication of the notice of the request for proposals, fewer than two proposals have been received from qualified providers, or fewer than two qualified providers attend the mandatory prebid meeting, the governmental unit may then open the proposals and select a qualified provider even if only one proposal is received.

(b) Preliminary Proposal Evaluation. – The governmental unit shall evaluate a sealed proposal from any qualified provider. A qualified reviewer shall be required to evaluate the proposals and will provide the governmental unit with a letter report containing both qualitative and quantitative evaluation of the proposals. The report may include a recommendation for selection, but the governmental unit is not obligated to follow it.

(c) Receipt of Proposals for Unit of Local Government. – In the case of a local governmental unit, proposals received pursuant to this section shall be opened by a member or an employee of the governing body of the local governmental unit at a public opening at which the contents of the proposals shall be announced and recorded in the minutes of the governing body. Proposals shall be evaluated for the local governmental unit by a qualified reviewer on the basis of:

(1) The information required in subsection (b) of this section; and

(2) The criteria stated in the request for proposals.

The local governmental unit may require a qualified provider to include in calculating the cost of a proposal for a guaranteed energy savings contract any reasonable fee payable by the local governmental unit for the evaluation of the proposal by a qualified reviewer not employed as a member of the staff of the local governmental unit or the qualified provider.

(c1) Receipt of Proposals for Unit of State Government. – In the case of a State governmental unit, proposals received pursuant to this section shall be opened by a member or an employee of the State governmental unit at a public opening and the contents of the proposals shall be announced at this opening. Proposals shall be evaluated for the State governmental unit by a qualified reviewer who is either privately retained, employed with the Department of Administration, or employed as a member of the staff of the State governmental unit. The proposal shall be evaluated on the basis of the information and report required in subsection (b) of this section and the criteria stated in the request for proposals.

The State governmental unit shall require a qualified provider to include in calculating the cost of a proposal for a guaranteed energy savings contract any reasonable fee payable by the State governmental unit for evaluation of the proposal by a qualified reviewer not employed as a member of the staff of the State governmental unit or the qualified provider. The Department of Administration may charge the State governmental unit a reasonable fee for the evaluation of the proposal if the Department's services are used for the evaluation and the cost paid by the State governmental unit to the Department of Administration shall be calculated in the cost of the proposal under this subsection.

(d) Criteria for Selection of Provider. – The governmental unit shall select the qualified provider that it determines to best meet the needs of the governmental unit by evaluating all of the following and following the procedures set forth in subsection (d1) of this section:

(1), (2) Repealed by Session Laws 2013-396, s. 2, effective August 23, 2013.

(3) Quality of the products and energy conservation measures proposed.

(4) Repealed by Session Laws 2013-396, s. 2, effective August 23, 2013.

(5) General reputation and performance capabilities of the qualified providers.

(6) Substantial conformity with the specifications and other conditions set forth in the request for proposals.
(7) Time specified in the proposals for the performance of the contract.
(8) Any other factors the governmental unit deems necessary, which factors shall be made a matter of record.

(d1) Process for Selection of Provider. – The governmental unit shall select a short list of finalists on the basis of its rankings of the written proposals under the criteria set forth in subsection (d) of this section as well as references from past clients. The governmental unit shall have the highest ranked qualified provider prepare a cost-savings analysis for the proposed contract showing at a minimum a comparison of the total estimated project savings to the total estimated project costs for the proposed term. If the governmental unit and the qualified provider cannot negotiate acceptable terms, pricing, and savings estimates, the governmental unit may terminate the process and begin negotiations with the second highest ranked qualified provider. The State Energy Office shall review the selected qualified provider's proposal, cost-benefit analysis, and other relevant documents prior to the governmental unit announcing the award.

(e) Nothing in this section shall limit the authority of governmental units as set forth in Article 3D of this Chapter. (1993 (Reg. Sess., 1994), c. 775, s. 3; 2002-161, s. 3; 2013-396, s. 2.)

§ 143-64.17B. Guaranteed energy savings contracts.

(a) A governmental unit may enter into a guaranteed energy savings contract with a qualified provider if all of the following apply:

(1) The term of the contract does not exceed 20 years from the date of the installation and acceptance by the governmental unit of the energy conservation measures provided for under the contract.
(2) The governmental unit finds that the energy savings resulting from the performance of the contract will equal or exceed the total cost of the contract.
(3) The energy conservation measures to be installed under the contract are for an existing building or utility system, or utility consuming device or equipment when the utility cost is paid by the governmental unit.

(b) Before entering into a guaranteed energy savings contract, the governmental unit shall provide published notice of the time and place or of the meeting at which it proposes to award the contract, the names of the parties to the proposed contract, and the contract's purpose. The notice must be published at least 15 days before the date of the proposed award or meeting.

(c) A qualified provider entering into a guaranteed energy savings contract under this Part shall provide security to the governmental unit in the form acceptable to the Office of the State Treasurer and in an amount equal to one hundred percent (100%) of the guaranteed savings for the term of the guaranteed energy savings contract to assure the provider's faithful performance. Any bonds required by this subsection shall be subject to the provisions of Article 3 of Chapter 44A of the General Statutes. If the savings resulting from a guaranteed energy savings contract are not as great as projected under the contract and all required shortfall payments to the governmental unit have not been made, the governmental unit may terminate the contract without incurring any additional obligation to the qualified provider.

(d) As used in this section, "total cost" shall include, but not be limited to, costs of construction, costs of financing, and costs of maintenance and training during the term of the contract less the application of the utility company, State, or federal incentives, grants, or rebates. "Total cost" does not include any obligations on termination of the contract before its expiration, provided that those obligations are disclosed when the contract is executed.

(e) A guaranteed energy savings contract may not require the governmental unit to purchase a maintenance contract or other maintenance agreement from the qualified provider who installs energy conservation measures under the contract if the unit of government takes appropriate action to budget for its own forces or another provider to maintain new systems installed and existing systems affected by the guaranteed energy savings contract.

(f) In the case of a State governmental unit, a qualified provider shall, when feasible, after the acceptance of the proposal of the qualified provider by the State governmental unit, conduct an investment grade audit. During this investment grade audit, the qualified provider shall perform in accordance with Part 1 of this Article a life cycle cost analysis of each energy conservation measure in the final proposal. If the results of the audit are not within ten percent (10%) of both the guaranteed savings contained in the proposal and the total proposal amount, either the State governmental unit or the qualified provider may terminate the project without incurring any additional obligation to the other party. However, if the State governmental unit terminates the project after the audit is conducted and the results of the audit are within ten percent (10%) of both the guaranteed savings contained in the proposal and the total proposal amount, the State governmental unit shall reimburse the qualified provider the reasonable cost incurred in conducting the audit, and the results of the audit shall become the property of the State governmental unit.

(g) A qualified provider shall provide an annual reconciliation statement based upon the results of the measurement and verification review. The statement shall disclose any shortfalls or surplus between guaranteed energy and operational savings specified in the guaranteed energy savings contract and actual, not stipulated, energy and operational savings incurred during a given guarantee year. Any guaranteed energy and operational savings shall be determined by using one of the measurement and verification methodologies listed in the United States Department of Energy's Measurement and Verification Guidelines for Energy Savings Performance Contracting, the International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization, or Guideline 14-2002 of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers. If due to existing data limitations or the nonconformance of specific project characteristics, none of the three methodologies listed in this subsection is sufficient for measuring guaranteed savings, the qualified provider shall develop an alternate method that is compatible with one of the three

methodologies and mutually agreeable to the governmental unit. The guarantee year shall consist of a 12-month term commencing from the time that the energy conservation measures become fully operational. A qualified provider shall pay the governmental unit or its assignee any shortfall in the guaranteed energy and operational savings after the total year savings have been determined. In the case of a governmental unit, a surplus in any one year shall not be carried forward or applied to a shortfall in any other year. (1993 (Reg. Sess., 1994), c. 775, s. 3; 1995, c. 295, s. 2; 1999-235, s. 3; 2002-161, s. 4; 2003-138, s. 1;
2006-190, s. 3; 2009-375, s. 2; 2013-396, s. 3; 2014-115, s. 56.7.)

§ 143-64.17C: Repealed by Session Laws 2002, ch. 161, s. 5, effective January 1, 2003, and applicable to contracts entered into on or after that date.

§ 143-64.17D. Contract continuance.

A guaranteed energy savings contract may extend beyond the fiscal year in which it becomes effective. Such a contract shall stipulate that it does not constitute a direct or indirect pledge of the taxing power or full faith and credit of any governmental unit. (1993 (Reg. Sess., 1994), c. 775, s. 3; 2002-161, s. 6.)

§ 143-64.17E. Payments under contract.

A local governmental unit may use any funds, whether operating or capital, that are not otherwise restricted by law for the payment of a guaranteed energy savings contract. State appropriations to any local governmental unit shall not be reduced as a result of energy savings occurring as a result of a guaranteed energy savings contract. (1993 (Reg. Sess., 1994), c. 775, s. 3.)

§ 143-64.17F. State agencies to use contracts when feasible; rules; recommendations.

(a) State governmental units shall evaluate the use of guaranteed energy savings contracts in reducing energy costs and may use those contracts when feasible and practical.

(b) The Department of Administration, in consultation with the Department of Environmental Quality, through the State Energy Office, shall adopt rules for: (i) agency evaluation of guaranteed energy savings contracts; (ii) establishing time periods for consideration of guaranteed energy savings contracts by the Office of State Budget and Management, the Office of the State Treasurer, and the Council of State, and (iii) setting measurements and verification criteria, including review, audit, and precertification. Prior to adopting any rules pursuant to this section, the Department shall consult with and obtain approval of those rules from the State Treasurer. The rules adopted pursuant to this subsection shall not apply to energy conservation measures implemented pursuant to G.S. 143-64.17L.

(c) The Department of Administration, and the Department of Environmental Quality through the State Energy Office, may provide to the Council of State its recommendations concerning any energy savings contracts being considered. (2002-161, s. 7; 2003-138, s. 2; 2009-446, s. 1(d); 2011-145, s. 9.6D(d); 2013-360, s. 15.22(d); 2015-241, s. 14.30(u).)

§ 143-64.17G. Report on guaranteed energy savings contracts entered into by local governmental units.

A local governmental unit that enters into a guaranteed energy savings contract must report the contract and the terms of the contract to the Local Government Commission and the State Energy Office of the Department of Environmental Quality. The Commission shall compile the information and report it biennially to the Joint Commission on Governmental Operations. In compiling the information, the Local Government Commission shall include information on the energy savings expected to be realized from a contract and, with the assistance of the Office of State Construction and the State Energy Office, shall evaluate whether expected savings have in fact been realized. (1993 (Reg. Sess., 1994), c. 775, s. 9; 2006-190, s. 4; 2009-375, s. 3; 2013-360, s. 15.22(e); 2015-241, s. 14.30(u).)

§ 143-64.17H. Report on guaranteed energy savings contracts entered into by State governmental units.

A State governmental unit that enters into a guaranteed energy savings contract or implements an energy conservation measure pursuant to G.S. 143-64.17L must report either (i) the contract and the terms of the contract or (ii) the implementation of the measure to the State Energy Office of the Department of Environmental Quality within 30 days of the date the contract is entered into or the measure is implemented. In addition, within 60 days after each annual anniversary date of a guaranteed energy savings contract, the State governmental unit must report the status of the contract to the State Energy Office, including any details required by the State Energy Office. The State Energy Office shall compile the information for each fiscal year and report it to the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, the Fiscal Research Division, and the Local Government Commission annually by December 1. In compiling the information, the State Energy Office shall include information on the energy savings expected to be realized from a contract or implementation and shall evaluate whether expected savings have in fact been realized. (2002-161, s. 8; 2006-190, s. 5; 2009-446, s. 1(c); 2011-145, s. 9.6D(e); 2013-360, s. 15.22(f); 2015-241, s. 14.30(u); 2017-57, s. 14.1(g).)

§ 143-64.17I. Installment and lease purchase contracts.

A local governmental unit may provide for the acquisition, installation, or maintenance of energy conservation measures acquired pursuant to this Part by installment or lease purchase contracts in accordance with and subject to the provisions of G.S. 160A-20 and G.S. 160A-19, as applicable. (2002-161, s. 8.)

§ 143-64.17J. Financing by State governmental units.

State governmental units may finance the acquisition, installation, or maintenance of energy conservation measures acquired pursuant to this Part in the manner and to the extent set forth in Article 8 of Chapter 142 of the General Statutes or as otherwise authorized by law. (2002-161, s. 8.)

§ 143-64.17K. Inspection and compliance certification for State governmental units.

The provisions of G.S. 143-341(3) shall not apply to any energy conservation measure for State governmental units provided pursuant to this Part, except as specifically set forth in this section. Except as otherwise exempt under G.S. 116-31.11, the following shall apply to all energy conservation measures provided to State governmental units pursuant to this Part:

(1) The provisions of G.S. 133-1.1.

(2) Inspection and certification by:

a. The applicable local building inspector under Part 4 of Article 18 of Chapter 153A of the General Statutes or Part 5 of Article 19 ofChapter 160A of the General Statutes; or

b. At the election of the State governmental unit, the Department of Administration under G.S. 143-341(3)d.

The cost of compliance with this section may be included in the cost of the project in accordance with G.S. 143-64.17A(c1) and may be included in the cost financed under Article 8 of Chapter 142 of the General Statutes. (2002-161, s. 8.)

§ 143-64.17L. Board of Governors may authorize energy conservation measures at constituent institutions.

(a) Authority. – Notwithstanding the provisions of this Part to the contrary, the Board of Governors of The University of North Carolina may authorize any constituent institution listed in subsection (e) of this section to implement an energy conservation measure without entering into a guaranteed energy savings contract if both of the following conditions are met:

(1) The Board of Governors finds that the energy savings resulting from the implementation of the energy conservation measure shall, according to the energy savings analysis received pursuant to G.S. 143-64.17M(a), equal or exceed the total cost of implementing the measure. If the proposed implementation will be financed with debt, then the energy savings analysis must project sufficient energy savings to pay the debt service on any bonds to be issued. As used in this subdivision, the term "total cost' shall have the same meaning as it does in G.S. 143-64.17B(d).

(2) The energy conservation measure is for an existing building or utility system.

(b) Scope of Authority. – In implementing an energy conservation measure pursuant to subsection (a) of this section, the Board of Governors may undertake or authorize any constituent institution listed in subsection (e) of this section to undertake any action that (i) could be required of a qualified provider under a guaranteed energy savings contract or (ii) is otherwise permissible under this Part.

(c) Projects Consisting of Multiple Energy Conservation Measures. – The Board of Governors may authorize the implementation of multiple energy conservation measures simultaneously as part of a single project. When doing so, the findings required by subsection (a) of this section may be made with respect to the project as a whole and need not be made with respect to individual energy conservation measures. Similarly, the analyses required by G.S. 143-64.17M may be conducted for the project as a whole instead of for individual energy conservation measures.

(d) Continuing Applicability of Part to Contracts. – If the Board of Governors or a constituent institution implements an energy conservation measure through a guaranteed energy savings contract, that contract shall accord in all respects with the requirements of this Part.

(e) The Board of Governors may authorize North Carolina State University and the University of North Carolina at Charlotte to implement an energy conservation measure without entering into a guaranteed energy savings contract pursuant to this section. (2011-145, s. 9.6D(a); 2013-396, s. 4(a).)

§§ 143-64.17L through 143-64.19. Reserved for future codification purposes.

§ 143-64.17M. Energy savings analysis required prior to implementation; post-implementation analyses required.

(a) Energy Savings Analysis Required Prior to Implementation. – Prior to implementing an energy conservation measure pursuant to G.S. 143-64.17L, an energy savings analysis shall be performed to validate the economic assumptions that purportedly support the implementation of the measure. This analysis shall be performed by a third party selected by the constituent institution and shall include an energy consumption analysis to develop a baseline of previous costs of all utilities' energy consumption for the institution on the assumption that the energy conservation measure was not undertaken. The completed analysis shall be submitted to The University of North Carolina System Office and to the State Energy Office.

(b) Post-Implementation Analyses Required. – A constituent institution that implements an energy conservation measure pursuant to G.S. 143-64.17L shall retain a third party to perform an annual measurement and verification of energy savings resulting from the energy conservation measure as compared to the baseline of previous costs set forth in the energy savings analysis required by subsection (a) of this section. The third party shall annually provide a reconciliation statement based upon the results of a preagreed upon measurement, monitoring, and verification protocol which shall disclose any shortfall or surplus between the estimated energy usage and operational savings set forth in the energy savings analysis required by subsection (a) of this section and actual, not stipulated, energy usage and operational savings incurred during a given year.

If a reconciliation statement reveals a shortfall in energy savings for a particular year, the constituent institution shall be responsible for and shall pay the shortfall. However, the institution shall not be held responsible for losses due to natural disasters or other emergencies. Any surplus shall be retained by the institution and may be used in the same manner as any other energy savings. (2011-145, s. 9.6D(b); 2018-12, s. 17.)

North Carolina Division of Employment Security

Appendix – 4
Energy Mandate for the North Carolina Division of Employment Security

The undersigned recognize that our utilities usage is a controllable expense in which reductions can be allocated to other needs within our operations budget, and that energy efficiency is the responsibility of all staff.

- The development and implementation of this Strategic Energy Plan is the responsibility of the undersigned Utilities Manager.
- The undersigned directors will support this Plan and report on progress annually.

Energy Mandate - Goal

The goal of this Plan is to reduce the annual total energy consumption per square foot of this complex to 40% below 2002-2003 levels.

Energy Mandate – Tracking Measures

- *Total Utilities use and cost per square foot*
- *Electric KWH use per square foot*
- *Gas BTU use per square foot*
- *Water use per square foot*

Energy Mandate – Commitment

1 March, 2021

Pryor Gibson	*Kevin Carlson*	*Joseph Katzberg*
Assistant Secretary	Chief Financial Officer	*Director of* Support Services

This **Energy Mandate** serves as a **Memorandum of Agreement** to support Strategic Energy Planning for state government as mandated in General Statutes 143-64.10 & 12.

This Energy Mandate serves as a Memorandum of Agreement to support Executive Order 80 effective 29 October, 2018.

Utility Management Plan

FY 2020 – FY 2021

Executive Order No. 80 Update

North Carolina Department of Environmental Quality

NCDEQ, 217 West Jones Street, Raleigh, NC 27603
Phone 877-623-6748; https://deq.nc.gov/

November 2020

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EXECUTIVE SUMMARY

The North Carolina Department of Environmental Quality (DEQ) is the lead stewardship agency for the protection of North Carolina's environmental resources. The DEQ reaches far and wide with offices from the mountains to the coast. Chief responsibilities include administering regulatory programs designed to protect air quality, water quality, and the public's health along with advancing energy efficiency. The majority of DEQ employees work in buildings owned by the Department of Administration or in leased buildings which are not included in the DEQ utility data. Only the State-owned facilities currently managed by DEQ are measured and tracked for the DEQ utility data. These facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. Mr. Eric Turon, based in Raleigh, is the DEQ Facilities Engineering Manager who champions all the energy conservation projects for both Reedy Creek and DMF. That encompasses a total of 99,335 gross square feet (GSF) of facilities and amounts to $424,607 total spent on utilities for fiscal year 2019-20.

The DEQ presents this Utility Management Plan in accordance with Article 3B of General Statute 143, “Conservation of Energy, Water, and Other Utilities in Government Facilities,” which authorizes DEQ to develop a comprehensive program to manage energy, water and other utility use for state government. Each agency is to develop and implement a management plan including strategies to support stated energy reduction goals, and update plans biennially. The first plan was issued Mar. 1, 2019 as mandated by Governor Cooper’s Executive Order No. 80 (EO80), North Carolina’s Commitment to Address Climate Change and Transition to a Clean Energy Economy dated October 29, 2018. This document will serve as the March 1, 2021 update. EO80 Section 8 requires Cabinet agencies to implement strategies to support a new energy consumption reduction goal of 40% by 2025. This goal surpasses the previous goal to reduce energy consumption in state government buildings 30% by 2015 as measured from a fiscal year (FY) 2002-03 baseline.

This updated utility management plan presents the recorded utility data along with strategies to achieve continued success in energy and water management for DEQ state-owned facilities both at Reedy Creek in Raleigh, and the Division of Marine Fisheries in Morehead City. Many DEQ employees work in buildings owned by the Department of Administration, or in leased buildings, which are not included in the utilities scope of this management plan. However, DEQ occupants which are considered tenants in buildings owned or leased by the state can make significant contributions to energy and water savings efforts through awareness and behavior, contributing toward the goals in EO80.

Last year, DEQ assumed responsibilities of the Maintenance Operations for the Reedy Creek complex from DOA. Since that time, DEQ has repaired and replaced a significant amount of equipment that was previously not running nor operable. For that reason, their energy usage has increased slightly from FY 2018-19 to FY 2019-20. However, some significant energy conservation projects have taken place and are planned. These include cool, white roofs, building automation systems, new HVAC systems, LED lighting upgrades, and electric vehicle chargers. Although DEQ is currently only showing a 32% energy reduction from their FY 2010-11 baseline, these projects will enable DEQ to meet the 40% energy reduction by 2025 as required with EO 80. Even though DEQ may reflect a relatively small footprint as compared to other cabinet agencies, DEQ is making great strides with energy conservation. The next few years should start to show the results of these improvements.

BACKGROUND

Efforts to measure and track energy use and cost in state buildings was highlighted in 2002 with the launch of the state's comprehensive program, the Utility Savings Initiative, pursuant to N.C.G.S. 143-64.10-12. At that time DEQ was known as the Department of Environment and Natural Resources (DENR.) DENR owned a few large buildings and a multitude of small buildings widely distributed across the state and across several divisions, including the NC Zoo, Parks and Recreation, and the NC Aquariums. Due to legislative changes in 2015, DENR was dismantled and now exists separately as the Department of Natural and Cultural Resources (DNCR) and the DEQ. That change effectively reduced DEQ's stock of buildings down to only two facilities. These two current DEQ facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. The Reedy Creek Laboratory Complex consists of three buildings constructed in 1991 along with two modular buildings with 54,304 sq. ft. of laboratory and office space. The DMF consists of four State owned facilities totaling 45,031 square feet of office space. The overall total area DEQ comprises is 99,335 gross square feet.

In order to reflect the gross square footage changes and restructuring more accurately, an attempt was made to separate utility and square footage data back to the original FY 2002-03 baseline, but lack of data at the division and building level proved to be an overwhelming task. Therefore, new baselines of FY 2010-11 were established for both DEQ and DNCR. The applicable utility and square footage data were separated and divided between the two agencies according to the relative composition of each agency today. This allows the overall energy reduction of each agency to be reflected and accounted for against a baseline that more closely resembles how each agency is currently structured. Otherwise, the agencies would be trying to achieve energy reductions on square footages that no longer exist and are no longer under their control. All the utility data and calculations within this report reflect the new FY2010-11 baseline.

The DEQ Reedy Creek and DMF facilities are managed by designated "site" energy managers, also serving as Capital Projects Coordinators, who are instrumental in achieving savings through capital improvement and repair projects and maintaining savings in energy and water. These sites report usage and cost annually and update management plans biennially as contributors to this DEQ management plan.

Many DEQ employees work in buildings owned by the Department of Administration or in leased buildings, which are not included in the utility scope of this management plan. However, DEQ occupants who are tenants in buildings owned or leased by the state can still make significant contributions to energy and water savings efforts through awareness and behavior. All DEQ employees can be a part of the statewide effort to save energy and water and to address climate change. Reducing energy consumption translates to a reduction in fossil fuels burned and a decrease in air pollution emitted. Water conservation is also becoming an increasingly important issue particularly during drought conditions.

UTILITY PERFORMANCE

The following tables present the energy, water, and performance data of the current DEQ facilities per GSF of building space for the Reedy Creek and Marine Fisheries locations combined using a baseline year of FY 2010-11. Table 1 shows the total amount spent on each utility along with the utility and energy cost per square feet. Utility costs include water and sewer whereas energy costs only include electricity and fuels. Per this data, electric is by far the major consumer followed by natural gas and water/sewer. Overall spending is reduced from the baseline but has increased over the past couple of years. This can be attributed to the work Reedy Creek has done to reinstate and replace a significant amount of non-operational equipment over the past couple of years.

Table 2 shows the DEQ energy reduction performance annually from the FY10-11 baseline. The EO80 goal is a 40% reduction, and DEQ currently stands at a 32% reduction. Although energy usage has increased over the past couple of years as Reedy Creek has improved and replaced inoperable equipment, the projects currently being installed and proposed should help them to attain the overall 40% reduction by 2025. Also of note is that approximately half of the DEQ space is used for laboratories which normally have a high energy use per square foot of space compared to a typical office. More detailed tables are available in the Appendix.

Table 1: DEQ Utility Cost Details

Fiscal year	Total Utility $	Total Energy $	Electric kwh $	Nat Gas $	Propane $	Water-sewer $	Total Utility $/GSF	Total Energy $/GSF	GSF
10-11	$572,246	$550,833	$428,428	$118,893	$ 3,512	$21,413	$5.42	$5.22	105,527
11-12	$502,132	$480,275	$372,292	$107,974	$ 8	$21,857	$4.76	$4.55	105,527
12-13	$444,867	$419,839	$363,472	$ 54,739	$ 1,628	$25,029	$4.22	$3.98	105,527
13-14	$485,174	$456,367	$384,948	$ 69,258	$ 2,161	$28,808	$4.60	$4.32	105,527
14-15	$470,151	$437,491	$370,135	$ 64,109	$ 3,247	$32,600	$4.46	$4.15	105,527
15-16	$393,311	$359,980	$302,288	$ 56,711	$ 981	$33,331	$3.73	$3.41	105,527
16-17	$373,231	$335,429	$277,124	$ 55,860	$ 2,445	$37,802	$3.54	$3.18	105,527
17-18	$341,919	$303,618	$236,851	$ 65,822	$ 945	$38,301	$2.82	$2.50	121,397
18-19	$378,914	$338,345	$280,824	$ 56,109	$ 1,411	$40,569	$3.81	$3.41	99,335
19-20	$424,607	$381,711	$283,710	$ 97,180	$ 822	$42,896	$4.27	$3.84	99,335

Table 2: DEQ Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	31,367,728,948	105,527	297,248	----
2011-12	28,777,710,158	105,527	272,705	-8%
2012-13	23,186,771,944	105,527	219,724	-26%
2013-14	22,477,883,549	105,527	213,006	-28%
2014-15	21,990,790,966	105,527	208,390	-30%
2015-16	22,049,504,628	105,527	208,947	-30%
2016-17	17,766,979,928	105,527	168,364	-43%
2017-18	18,432,835,063	121,397	151,839	-49%
2018-19	18,721,241,491	99,335	188,466	-37%
2019-20	19,992,304,434	99,335	201,261	-32%

DIVISION OF MARINE FISHERIES

The Department of Environmental Quality (DEQ), Division of Marine Fisheries (DMF) consists of four state owned facilities totaling 45,031 square feet located in Carteret County, North Carolina with the main headquarters in Morehead City. DMF shares space with other state agencies at six other locations that are leased facilities throughout the eastern region of the state. None of the leased facilities are included in the utility scope of this management plan. DMF spent a total of $155,532 on utilities for the FY19-20 year.

DMF works closely with DEQ to comply with the overall department Strategic Energy Plan (SEP) and supports the initiative to reduce energy consumption by 40 percent by 2025 as directed by the Governor's Executive Order No. 80. Currently, DMF is trending in the right direction to accomplish the goal but, much depends on whether sufficient Repair and Renovation (R&R) funding is received. The replacing of equipment with more efficient types and renovating with energy conservation measures are a high priority. Educating employees to be more aware of energy savings initiatives is also vital to accomplish our goals. DMF is working with DEQ to secure grants to change out LED lights and to install EV chargers. DMF is currently at an 18% energy reduction from their FY10-11 baseline as shown in Table 3 below.

Table 3: DMF Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	7,827,451,270	45,031	173,824	----
2011-12	9,210,378,678	45,031	204,534	18%
2012-13	7,997,642,651	45,031	177,603	2%
2013-14	8,442,216,980	45,031	187,476	8%
2014-15	8,269,790,588	45,031	183,647	6%
2015-16	9,674,385,185	45,031	214,838	24%
2016-17	7,772,732,988	45,031	172,608	-1%
2017-18	8,057,443,355	45,031	178,931	3%
2018-19	7,683,608,235	45,031	170,629	-2%
2019-20	6,432,374,826	45,031	142,843	-18%

NC Division of Marine Fisheries Energy Related Projects

DMF Noteworthy Energy Related Projects Already Completed

Project Description	Cost	Funding	Estimated Savings	Completion
HVAC Chiller & Replacement	$ 161,000	R&R	$ 9,500	2014
Elevator Modernization	$ 172,000	R&R	undetermined	2015
Maintenance Building Restrooms Renovation (Emergency Project)	$ 202,596	Special Funds	undetermined	2018
Maintenance Building Roof Replacement	$ 209,000	R&R	undetermined	2019
HVAC Controls System Upgrade and Standby Generator	$ 417,000	R&R	undetermined	2019
Main Building Complex Roof Replacement	$ 463,000	R&R	undetermined	2020

DMF Proposed Energy Related Projects

Project Description	Cost	Funding	Estimated Savings	Completion
Campus LED Lighting Conversion	100000	TBD	undetermined	TBD
Installation of Electric Vehicle Chargers	30000	TBD	undetermined	TBD

Plan of Action

DMF has submitted 10 projects in the six-year plan for 2019-2025 Reserve for Repairs and Renovations (R&R) and 40 percent of those projects will have an impact on energy efficiency. DMF will continue to strive to meet energy reduction goals, but funding for R&R projects is imperative to achieve DMF's goals.

DIVISIONS OF WATER RESOURCES AND AIR QUALITY AT REEDY CREEK LABORATORY

The Reedy Creek Laboratory Complex brings together the analytical capabilities of the Division of Water Resources and the Division of Air Quality. These capabilities include chemical analysis and biological assessment for determinations of environmental quality. The Complex consists of three buildings constructed in 1991 along with two modular buildings with 54,304 sq. ft. of laboratory and office space. These structures experienced numerous problems early on with the roofs of all three buildings requiring replacement within the first ten years. Partly due to the nature of the buildings being laboratories, numerous other problems emerged as the buildings aged. The Chemistry Laboratory was plagued by serious problems with air balance within the building. Energy consumption, particularly natural gas usage, seemed to be high for the size of the buildings. Comfort of the occupants and reliable conditions within the analytical instrument requirements were inferior to what would be expected for a building this age.

A study was done in 2007 to identify the problems and to recommend steps necessary to remedy the situation. Those recommendations were translated into requests for Repair and Renovation (R&R) funding and numerous projects have been taken to improve the occupant comfort, the environment for the analytical instruments, and energy conservation measures for the complex.

In 2012, the HVAC system in the Chemistry Laboratory was renovated, a new chiller was installed serving the whole complex and numerous other measures were taken to improve safety, comfort and energy conservation. The result is a building that can be relied upon to better serve staff and to save energy.

In 2016, the boiler serving the complex was replaced as well as air handling units in the other two buildings. The HVAC controls were not replaced but are part of an additional project that is about to commence. The buildings have reliable heat and cooling, but the coordination of the controls is lacking and extremely important. In May of 2020 DEQ Facilities Services installed analytics software on the existing HVAC system controls to help troubleshoot daily operational issues as well as track energy usage.

In December 2019 DEQ created and staffed a Facilities Services Department to support fully the Lab campus 24/7. Day to day maintenance responsibilities were transferred from DOA Facilities Services (who were service fee based) over to DEQ Facilities Services. All critical infrastructure equipment was put onto a Preventative Maintenance System. Additionally, an electronic asset inventory system was implemented with all equipment assets in the process of being asset tagged and logged into the system. Since December 2019 DEQ Facilities Services has spent over $550,000 on critical infrastructure and equipment repairs to ensure lab operations experience minimal interruption of services. Some of those repairs include:

- Installation of 80 Uninterrupted Power Supplies and Surge Protection Devices on all electronic pieces of lab equipment.
- Replacement of the broken gas main and meter.
- Infra-Red and Arc Flash Analysis on all campus electrical supply system, repairs made as identified in analysis.
- Repairs to campus generator, installation of remote monitoring system.
- Several HVAC repairs.
- Analytic Software installed on HVAC controls system.
- Convert 16 broken parking lot pole lights to LED.
- Replace burned out exterior lighting to LED.

The staff at the Reedy Creek complex is committed to, and takes pride in, working with the DEQ to comply and to exceed the energy reduction goal set out by the Governor in Executive Order No. 80. We are an environmental agency and committed to reduce the environmental impact of our operations as we carry out the mission of the Department. Reedy Creek is currently at a 36% energy reduction from their FY10-11 baseline as shown in Table 4 below. Their total utility spending was $269,074 for FY19-20.

Table 4: Reedy Creek Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	23,540,277,678	60,496	389,121	----
2011-12	19,567,331,480	60,496	323,448	-17%
2012-13	15,189,129,293	60,496	251,077	-35%
2013-14	14,035,666,569	60,496	232,010	-40%
2014-15	13,721,000,378	60,496	226,808	-42%
2015-16	12,375,119,444	60,496	204,561	-47%
2016-17	9,994,246,940	60,496	165,205	-58%
2017-18	10,375,391,708	76,366	135,864	-65%
2018-19	11,037,633,256	54,304	203,256	-48%
2019-20	13,559,929,608	54,304	249,704	-36%

NC Division of Water Resources and Air Quality-Reedy Creek Labs Projects

Reedy Creek Noteworthy Energy Related Projects Already Completed or In Progress

Project Description	Cost	Funding	Estimated Savings	Completion
HVAC Chiller Replacement & Chemistry Lab Renovations	$ 1,205,973	ARRA	$ 57,000	2012
	$ 982,000	R&R		
Boiler & Air Handler Replacement in DAQ & DWQ Buildings	$ 632,846	R&R	undetermined	2020
HVAC Renovations & DDC Controls - DAQ & DWQ Labs	$ 265,000	R&R	undetermined	Jun-21
HVAC Ductwork & VAV Box Replacements - DAQ & DWQ	$ 496,000	R&R	undetermined	Jun-21
Cooling Tower Replacement & Evaporation Credit Meter	$ 159,000	R&R	undetermined	Dec-21
Glycol Energy Loop Refurbishment - DWQ Building	$ 35,000	R&R	undetermined	2020
Campus Lighting Retrofit from T12 to LED	$ 114,000	DOE Grant	$ 20,000	2020
	$ 46,000	Duke Rebates		
Cool Roof Replacements for buildings 4401 and 4403	$ 567,000	R&R	$ 6,440	Jun-21
Reflective window blinds for entire campus	$ 14,000	Gen. Fund	undetermined	Dec-20

Reedy Creek Proposed Energy Related Projects

Project Description	Cost	Funding	Estimated Savings	Completion
Installation of Electric Vehicle Chargers	$ 30,000	TBD	undetermined	TBD

Plan of Action

The Reedy Creek Lab Complex will continue the efforts already underway to improve the energy efficiency of the buildings in the complex. We will continue to seek new ways to save energy through improvements to the buildings, their operations and their maintenance. The support provided by the Department of Environmental Quality has been and will continue to be critical for the complex to carry out its mission and set an example for environmental stewardship.

DECLARATION OF SUPPORT FOR
DEPARTMENT OF ENVIRONMENTAL QUALITY
UTILITY MANAGEMENT PLAN

We recognize that:

- Energy and water consumption can be managed to the benefit of our agency.
- Energy and water management is a responsibility of the staff at each facility.

This Agency will implement a Utility Management Plan. Eric Turon, Facilities Engineering Manager, is responsible for the implementation of the Program at this agency.

The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

The Division staff will review progress and results quarterly and will support staff attendance at training in energy and water management.

Utility Management Plan Mandate- Goals

Agency will reduce annual Total Energy Use Btu per Square Foot by a minimum of 40% by fiscal year 2024-2025 from a baseline fiscal year 2002-2003. We will also continue to track and manage water consumption.

Utility Management Plan Mandate- Measures

Our tracking measures will be the following State Key Performance Indicators (KPI):

- *Total Energy Use Btu per Square Foot*
- *Total Utilities Cost per Square Foot*
- *Total Energy Cost per Square Foot*

I have read and will support the Utility Management Plan for my Organization.

Implemented this 16 day of December, 2020

DocuSigned by:
John A. Nicholson
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Chief Deputy Secretary

DocuSigned by:
Kimberly L. Van Metre
28637E8036744BF...
Chief Financial Officer

DocuSigned by:
Eric Turon
0FF56BADAAA04B9...
Facilities Engineering Manager

Submitted by:

Julie Pfeiffer
Utility Savings Initiative

Appendix of Tables for NCDEQ Utility Management Plan
FY 2020 – FY 2021 Executive Order No. 80 Update

Appendix Table 1: DEQ Buildings Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 5.22	$ 17.56		297,243	
2011-12	$ 4.55	$ 16.69	-5%	272,705	-8%
2012-13	$ 3.98	$ 18.11	3%	219,721	-26%
2013-14	$ 4.32	$ 20.30	16%	213,004	-28%
2014-15	$ 4.15	$ 19.89	13%	208,387	-30%
2015-16	$ 3.41	$ 16.33	-7%	208,946	-30%
2016-17	$ 3.18	$ 18.88	8%	168,362	-43%
2017-18	$ 2.50	$ 16.47	-6%	151,839	-49%
2018-19	$ 3.41	$ 18.07	3%	188,464	-37%
2019-20	$ 3.84	$ 19.09	9%	201,261	-32%

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year which puts the total energy reduction for DEQ at 32% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline.

Appendix Table 2: DEQ Buildings Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $	Propane gals	Propane $
10-11	$550,833	31,367	4,968,293	$ 428,428	142,512	$118,893	1792	$ 3,512
11-12	$480,275	28,778	4,305,027	$ 372,292	140,885	$107,974	5	$ 8
12-13	$419,839	23,187	4,660,789	$ 363,472	72,022	$ 54,739	891	$ 1,628
13-14	$456,367	22,478	4,149,933	$ 384,948	82,629	$ 69,258	603	$ 2,161
14-15	$437,491	21,991	3,945,660	$ 370,135	84,412	$ 64,109	947	$ 3,247
15-16	$359,980	22,049	3,402,930	$ 302,288	104,136	$ 56,711	273	$ 981
16-17	$335,429	17,767	3,184,744	$ 277,124	68,325	$ 55,860	741	$ 2,445

17-18	$303,618	18,433	3,040,599	$ 236,851	80,339	$ 65,822	265	$ 945
18-19	$338,345	18,721	3,418,012	$ 280,824	70,161	$ 56,109	466	$ 1,411
19-20	$381,711	19,992	3,224,230	$ 283,710	89,659	$ 97,180	276	$ 822

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year with most of that increase occurring in the cost of Natural gas. Actual therms used only rose slightly, but the cost almost doubled.

Appendix Table 3: DEQ Buildings Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 572,246	$ 550,833	$ 21,413	$ 5.42	$ 5.22	$ 0.20	105527
2011-12	$ 502,132	$ 480,275	$ 21,857	$ 4.76	$ 4.55	$ 0.21	105527
2012-13	$ 444,867	$ 419,839	$ 25,029	$ 4.22	$ 3.98	$ 0.24	105527
2013-14	$ 485,174	$ 456,367	$ 28,808	$ 4.60	$ 4.32	$ 0.27	105527
2014-15	$ 470,151	$ 437,491	$ 32,660	$ 4.46	$ 4.15	$ 0.31	105527
2015-16	$ 393,311	$ 359,980	$ 33,331	$ 3.73	$ 3.41	$ 0.32	105527
2016-17	$ 373,231	$ 335,429	$ 37,802	$ 3.54	$ 3.18	$ 0.36	105527
2017-18	$ 341,919	$ 303,618	$ 38,301	$ 2.82	$ 2.50	$ 0.32	121,397
2018-19	$ 378,914	$ 338,345	$ 40,569	$ 3.81	$ 3.41	$ 0.41	99,335
2019-20	$ 424,607	$ 381,711	$ 42,896	$ 4.27	$ 3.84	$ 0.43	99,335

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year, but this shows the increase was not due to significant increases in water/sewer.

Appendix Table 4: DEQ Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 21,413.00	1,507	$ 14.21		14.28		$ 0.20	105,527
2011-12	$ 21,857.00	1,442	$ 15.16	7%	13.66	-4%	$ 0.21	105,527
2012-13	$ 25,029.00	2,417	$ 10.36	-27%	22.90	60%	$ 0.24	105,527

2013-14	$ 28,808.00	3,114	$ 9.25	-35%	29.51	107%	$ 0.27	105,527
2014-15	$ 32,600.00	2,597	$ 12.58	-11%	24.61	72%	$ 0.31	105,527
2015-16	$ 33,331.00	2,450	$ 13.60	-4%	23.22	63%	$ 0.32	105,527
2016-17	$ 37,802.00	2,482	$ 15.23	7%	23.52	65%	$ 0.36	105,527
2017-18	$ 38,301.00	2,652	$ 14.44	2%	21.85	53%	$ 0.32	121,397
2018-19	$ 40,569.37	2,915	$ 13.92	-2%	29.34	105%	$ 0.41	99,335
2019-20	$ 42,895.84	2,547	$ 16.84	18%	25.65	80%	$ 0.43	99,335

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Water and sewer costs have risen slightly during the last fiscal year, but usage has decreased. Water and sewer costs have risen significantly.

Appendix Table 5: DEQ Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Propane $/gal	Electric $/therm	Nat Gas $/therm	Propane $/therm
2010-11	$ 0.086	$ 0.834	$ 1.96	$ 2.53	$ 0.83	$ 2.13
2011-12	$ 0.086	$ 0.766	$ 1.67	$ 2.53	$ 0.77	$ 1.81
2012-13	$ 0.078	$ 0.760	$ 1.83	$ 2.29	$ 0.76	$ 1.99
2013-14	$ 0.093	$ 0.838	$ 3.58	$ 2.72	$ 0.84	$ 3.90
2014-15	$ 0.094	$ 0.759	$ 3.43	$ 2.75	$ 0.76	$ 3.73
2015-16	$ 0.089	$ 0.545	$ 3.59	$ 2.60	$ 0.54	$ 3.91
2016-17	$ 0.087	$ 0.818	$ 3.30	$ 2.55	$ 0.82	$ 3.59
2017-18	$ 0.078	$ 0.819	$ 3.57	$ 2.28	$ 0.82	$ 3.87
2018-19	$ 0.082	$ 0.800	$ 3.03	$ 2.41	$ 0.80	$ 3.29
2019-20	$ 0.088	$ 1.084	$ 2.98	$ 2.58	$ 1.08	$ 3.24

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Costs for electricity and natural gas have increased while propane cost has decreased slightly.

Appendix Table 6: Reedy Creek Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 6.49	$ 16.68		389,121	
2011-12	$ 5.25	$ 16.22	-3%	323,448	-17%
2012-13	$ 4.55	$ 18.11	9%	251,077	-35%
2013-14	$ 4.98	$ 21.45	29%	232,010	-40%
2014-15	$ 4.88	$ 21.53	29%	226,808	-42%
2015-16	$ 3.99	$ 19.51	17%	204,561	-47%
2016-17	$ 3.45	$ 20.89	25%	165,205	-58%
2017-18	$ 2.23	$ 16.40	-2%	135,864	-65%
2018-19	$ 3.48	$ 17.10	2%	203,256	-48%
2019-20	$ 4.40	$ 17.62	6%	249,704	-36%

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year which puts the total energy reduction for Reedy Creek at 36% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline.

Appendix Table 7: Reedy Creek Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $
10-11	$392,738	23,540	3,489,360	$ 297,218	115,097	$ 92,821
11-12	$317,336	19,567	2,798,368	$ 248,462	100,193	$ 68,874
12-13	$275,076	15,189	3,319,440	$ 248,771	38,632	$ 26,305
13-14	$301,077	14,036	2,794,363	$ 266,575	45,013	$ 34,502
14-15	$295,430	13,721	2,726,751	$ 262,718	44,173	$ 32,712
15-16	$241,420	12,375	2,327,250	$ 212,295	44,345	$ 29,126
16-17	$208,790	9,994	2,081,784	$ 186,380	28,912	$ 22,410
17-18	$170,121	10,375	1,909,259	$ 144,950	38,610	$ 25,171
18-19	$188,736	11,038	2,040,338	$ 161,018	40,760	$ 27,719
19-20	$238,864	13,560	2,107,834	$ 162,015	63,680	$ 76,848

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year with most of that increase occurring in the cost of Natural gas. Actual therms used has increased by about 50%, but the cost almost tripled. Most of the increased usage can be attributed to the significant amount of equipment that was restored to working order over the past couple of years.

Appendix Table 8: Reedy Creek Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 404,801	$ 392,738	$ 12,063	$ 3.84	$ 3.72	$ 0.11	105527
2011-12	$ 332,094	$ 317,336	$ 14,757	$ 3.15	$ 3.01	$ 0.14	105527
2012-13	$ 292,121	$ 275,076	$ 17,045	$ 2.77	$ 2.61	$ 0.16	105527
2013-14	$ 323,020	$ 301,077	$ 21,943	$ 3.06	$ 2.85	$ 0.21	105527
2014-15	$ 318,127	$ 295,430	$ 22,698	$ 3.01	$ 2.80	$ 0.22	105527
2015-16	$ 264,120	$ 241,420	$ 22,700	$ 2.50	$ 2.29	$ 0.22	105527
2016-17	$ 236,511	$ 208,790	$ 27,721	$ 2.24	$ 1.98	$ 0.26	105527
2017-18	$ 197,546	$ 170,121	$ 27,425	$ 1.63	$ 1.40	$ 0.23	121,397
2018-19	$ 219,331	$ 188,736	$ 30,595	$ 2.21	$ 1.90	$ 0.31	99,335
2019-20	$ 269,074	$ 238,864	$ 30,211	$ 2.71	$ 2.40	$ 0.30	99,335

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year, but this shows the increase was not due to significant increases in water/sewer.

Appendix Table 9: Reedy Creek Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 12,063.47	966	$ 12.49		15.97		$ 0.11	105,527
2011-12	$ 14,757.38	792	$ 18.63	49%	13.09	-18%	$ 0.14	105,527
2012-13	$ 17,044.63	1,797	$ 9.49	-24%	29.70	86%	$ 0.16	105,527
2013-14	$ 21,943.31	2,617	$ 8.38	-33%	43.26	171%	$ 0.21	105,527
2014-15	$ 22,697.54	1,930	$ 11.76	-6%	31.90	100%	$ 0.22	105,527
2015-16	$ 22,699.65	1,826	$ 12.43	0%	30.18	89%	$ 0.22	105,527
2016-17	$ 27,720.90	1,902	$ 14.57	17%	31.44	97%	$ 0.26	105,527

2017-18	$ 27,425.15	2,059	$ 13.32	7%	26.96	69%	$ 0.23	121,397
2018-19	$ 30,594.76	2,300	$ 13.30	7%	42.35	165%	$ 0.31	99,335
2019-20	$ 30,210.80	2,233	$ 13.53	8%	41.11	157%	$ 0.30	99,335

This table shows data for Reedy Creek alone. Water and sewer costs have remained relatively stable during the last fiscal year.

Appendix Table 10: Reedy Creek Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Electric $/therm	Nat Gas $/therm
2010-11	$ 0.085	$ 0.806	$ 2.50	$ 0.81
2011-12	$ 0.089	$ 0.687	$ 2.60	$ 0.69
2012-13	$ 0.075	$ 0.681	$ 2.20	$ 0.68
2013-14	$ 0.095	$ 0.766	$ 2.80	$ 0.77
2014-15	$ 0.096	$ 0.741	$ 2.82	$ 0.74
2015-16	$ 0.091	$ 0.657	$ 2.67	$ 0.66
2016-17	$ 0.090	$ 0.775	$ 2.62	$ 0.78
2017-18	$ 0.076	$ 0.652	$ 2.23	$ 0.65
2018-19	$ 0.079	$ 0.680	$ 2.31	$ 0.68
2019-20	$ 0.077	$ 1.207	$ 2.25	$ 1.21

This table shows data for Reedy Creek alone. The cost for natural gas has almost doubled while electricity has decreased very slightly.

Appendix Table 11: DMF Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 3.51	$ 20.20		173,824	
2011-12	$ 3.62	$ 17.69	-12%	204,534	18%
2012-13	$ 3.21	$ 18.10	-10%	177,603	2%
2013-14	$ 3.45	$ 18.39	-9%	187,476	8%
2014-15	$ 3.15	$ 17.18	-15%	183,647	6%

2015-16	$ 2.63	$ 12.26	-39%	214,838	24%
2016-17	$ 2.81	$ 16.29	-19%	172,608	-1%
2017-18	$ 2.96	$ 16.57	-18%	178,931	3%
2018-19	$ 3.32	$ 19.47	-4%	170,629	-2%
2019-20	$ 3.17	$ 22.21	10%	142,843	-18%

This table shows data for DMF alone. Energy used per gross square foot has decreased slightly during the last fiscal year which puts the total energy reduction for DMF at 18% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline. DMF still has significant work to do before achieving a 40% energy reduction goal.

Appendix Table 12: DMF Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $	Propane gals	Propane $
10-11	$158,095	7,827	1,478,933	$ 131,211	27,415	$ 26,072	433	$ 812
11-12	$162,939	9,210	1,506,659	$ 123,830	40,692	$ 39,101	5	$ 8
12-13	$144,762	7,998	1,341,349	$ 114,700	33,390	$ 28,434	891	$ 1,628
13-14	$155,290	8,442	1,355,570	$ 118,373	37,616	$ 34,756	603	$ 2,161
14-15	$142,061	8,270	1,218,909	$ 107,417	40,238	$ 31,397	947	$ 3,247
15-16	$118,560	9,674	1,075,680	$ 89,993	59,791	$ 27,586	273	$ 981
16-17	$126,639	7,773	1,102,960	$ 90,744	39,413	$ 33,450	741	$ 2,445
17-18	$133,498	8,057	1,131,340	$ 91,900	41,729	$ 40,652	265	$ 945
18-19	$149,608	7,684	1,377,674	$ 119,806	29,401	$ 28,391	466	$ 1,411
19-20	$142,847	6,432	1,116,396	$ 121,694	25,979	$ 20,332	276	$ 822

This table shows data for DMF alone. Energy costs except for electricity have decreased slightly during the last fiscal year.

Appendix Table 13: DMF Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 167,445	$ 158,095	$ 9,350	$ 1.59	$ 1.50	$ 0.09	105527
2011-12	$ 170,038	$ 162,939	$ 7,100	$ 1.61	$ 1.54	$ 0.07	105527
2012-13	$ 152,746	$ 144,762	$ 7,984	$ 1.45	$ 1.37	$ 0.08	105527
2013-14	$ 162,155	$ 155,290	$ 6,865	$ 1.54	$ 1.47	$ 0.07	105527
2014-15	$ 152,024	$ 142,061	$ 9,962	$ 1.44	$ 1.35	$ 0.09	105527
2015-16	$ 129,191	$ 118,560	$ 10,631	$ 1.22	$ 1.12	$ 0.10	105527
2016-17	$ 136,720	$ 126,639	$ 10,081	$ 1.30	$ 1.20	$ 0.10	105527
2017-18	$ 144,373	$ 133,498	$ 10,876	$ 1.19	$ 1.10	$ 0.09	121,397
2018-19	$ 159,583	$ 149,608	$ 9,975	$ 1.61	$ 1.51	$ 0.10	99,335
2019-20	$ 155,532	$ 142,847	$ 12,685	$ 1.57	$ 1.44	$ 0.13	99,335

This table shows data for DMF alone. Energy costs have decreased slightly during the last fiscal year, but water and sewer costs have increased a small amount.

Appendix Table 14: DMF Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 9,350	541	$ 17.28		12.01		$ 0.09	105,527
2011-12	$ 7,100	650	$ 10.93	-37%	14.42	20%	$ 0.07	105,527
2012-13	$ 7,984	619	$ 12.89	-25%	13.76	15%	$ 0.08	105,527
2013-14	$ 6,865	497	$ 13.82	-20%	11.03	-8%	$ 0.07	105,527
2014-15	$ 9,962	667	$ 14.93	-14%	14.82	23%	$ 0.09	105,527
2015-16	$ 10,631	624	$ 17.04	-1%	13.85	15%	$ 0.10	105,527
2016-17	$ 10,081	580	$ 17.38	1%	12.88	7%	$ 0.10	105,527
2017-18	$ 10,876	593	$ 18.33	6%	13.18	10%	$ 0.09	121,397
2018-19	$ 9,975	615	$ 16.21	-6%	13.66	14%	$ 0.10	99,335
2019-20	$ 12,685	315	$ 40.30	133%	6.99	-42%	$ 0.13	99,335

This table shows data for DMF alone. Water and sewer costs have risen sharply during the last fiscal year, but usage has almost halved. The drastic change in this data could possibly be traced to a reporting error.

Appendix Table 15: DMF Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Propane $/gal	Electric $/therm	Nat Gas $/therm	Propane $/therm
2010-11	$ 0.089	$ 0.951	$ 1.87	$ 2.60	$ 0.95	$ 2.04
2011-12	$ 0.082	$ 0.961	$ 1.60	$ 2.41	$ 0.96	$ 1.74
2012-13	$ 0.086	$ 0.852	$ 1.83	$ 2.51	$ 0.85	$ 1.99
2013-14	$ 0.087	$ 0.924	$ 3.59	$ 2.56	$ 0.92	$ 3.90
2014-15	$ 0.088	$ 0.780	$ 3.43	$ 2.58	$ 0.78	$ 3.73
2015-16	$ 0.084	$ 0.461	$ 3.60	$ 2.45	$ 0.46	$ 3.91
2016-17	$ 0.082	$ 0.849	$ 3.30	$ 2.41	$ 0.85	$ 3.59
2017-18	$ 0.081	$ 0.974	$ 3.56	$ 2.38	$ 0.97	$ 3.87
2018-19	$ 0.087	$ 0.966	$ 3.03	$ 2.55	$ 0.97	$ 3.29
2019-20	$ 0.109	$ 0.783	$ 2.98	$ 3.19	$ 0.78	$ 3.24

This table shows data for DMF alone. Costs for electricity has increased while natural gas and propane costs have decreased slightly.

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Browsers (for SIGNERS):	Internet Explorer 6.0?, Mozilla FireFox 1.0, NetScape 7.2 (or above)
Email:	Access to a valid email account
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Strategic Energy and Water Plan

North Carolina Department of Health and Human Services

August 28, 2020

Prepared By:

Division of Property & Construction

3026 Mail Service Center

Raleigh, NC 27699-3026

Executive Summary

The North Carolina Department of Health and Human Services (DHHS) has approximately 635 buildings at 14 different institutions across the state encompassing roughly 7.6 million square feet of space. These institutions include psychiatric hospitals, neuro-medical treatment centers, alcohol and drug abuse treatment centers, developmental centers, and vocational rehabilitation centers.

DHHS is committed to improving building energy performance and water consumption at these institutions to reduce costs and the potential for any negative impact to the environment.

DHHS will reduce energy and water usage by identifying and implementing projects to improve the efficiency of utility systems. DHHS has utilized various funding sources including American Recovery and Reinvestment Act (ARRA) and repair and renovation funds to complete energy conservation projects.

General Items for the DHHS Strategic Energy and Water Plan include the following:

1. Consolidating building occupants in buildings with a high square foot per person so that buildings may be closed off and HVAC system temperatures set back or turned off completely.

2. Recommissioning existing HVAC control systems in order to optimize energy savings. Verification of proper outdoor air set points on HVAC systems.

3. Tuning up of existing boilers to provide optimal burner efficiency.

4. When HVAC equipment is due for replacement, replace this equipment with high efficiency replacements. When office equipment and appliances are due for replacement, replace with energy star rated equipment.

5. Survey each campus for energy savings opportunities. Identify system leaks and repair them.

6. Replace existing lighting (incandescent or fluorescent) with LED lighting.

7. Install lighting occupancy sensors in appropriate areas/rooms.

8. Implement temperature setbacks for non-occupied time periods for non-patient areas. Provide proper deadband between heating and cooling setpoints in all occupancies.

9. Prohibit personal space heaters and mini refrigerators.

10. Repair and caulk leaks in windows and doors. Add building insulation where needed or where it does not exist.

Current elements of the DHHS Strategic Energy and Water Plan include the following:

1. Identifying and implementing renovation projects when required due to the age and condition or change in use of buildings. The requirements of General Statute 143.135-25 which mandates minimum energy and water reduction for new construction and major renovation projects will ensure improved energy and water use performance.

These improvements generally include some or all the following: replacing windows; upgrading building insulation; and replacing HVAC, controls, lighting, and plumbing systems.

1. Lighting replacement with LED fixtures at multiple facilities.

2. At J. Iverson Riddle Developmental Center, replace the domestic water heater at the Mulberry Building.

3. At J. Iverson Riddle Developmental Center, replace aging domestic water and sewer piping.

4. At John Umstead Campus, upgrade the HVAC system at Building 27A.

5. At Julian Keith ADATC, upgrade Dorms 1 & 2.

6. At Julian F. Keith ADATC, replace the aging condensing unit at the Activities/Gym Building.

7. At O'Berry NMTC, upgrade the HVAC system at the Administration Building.

8. At O'Berry NMTC, replace the windows at ELC-2.

9. Completing various selected smaller projects in buildings to address specific needs and to reduce energy and water usage including replacing existing inefficient HVAC equipment with modern and energy efficient equipment.

An Energy Manager (Maintenance Director) is assigned at each institution to ensure that energy conservation projects are completed in a timely manner.

The main Key Performance Indicators (KPIs) consist of British thermal units per gross square foot (btu/gsf) for energy use and gallons/gsf for water use. Due to the expense of metering each building, utility invoices will be utilized to monitor and report overall energy and water usage for each facility.

Organizational Support for Energy Culture Change

1. Educate staff through presentations, emails, handouts, subcommittees, and other effective forms of communication about energy and water conservation practices they can implement daily.

2. Incorporate energy and water conservation discussions and presentations as appropriate into institutional and departmental meetings.

3. Encourage staff to identify and attend energy and water conservation training.

4. Establish policy that requires evaluation of both costs and energy efficiency when selecting equipment to be purchased and that requires giving preference to Energy Star products when possible.

Organizational Culture Change Projects

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Continuation of existing activities							Facility Maintenance and Division of Property & Construction	GF

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Educate staff regarding NC energy legislation, State Energy Office policies and resources, and Strategic Energy Planning techniques.							Facility Maintenance and Division of Property & Construction	GF
Encourage staff to identify and attend energy and water conservation training.							Facility Maintenance and Division of Property & Construction	GF
Establish policy that requires evaluation of both costs and energy efficiency when selecting equipment to be purchased and that requires giving preference to Energy Star products when possible.							Facility Maintenance and Division of Property & Construction	GF

1. Supply Side

a. Review all accounts with utility providers to ensure lowest cost Rate Schedule is in effect for each facility.

b. Identify locations, meter ID, and account numbers for all existing primary meters installed by utility providers. Request utility providers to install new digital meters to replace any analog meters. Request new digital meters to be remote reading type compatible with existing Building Management System (BMS) software whenever possible.

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Continuation of existing activities							Facility Energy Manager and Division of Property & Construction	GF

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Contact Duke Progress and the local utility provider to review all electrical rates							Facility Energy Manager	GF
Contact Piedmont Natural Gas to review all gas rates							Facility Energy Manager	GF
Contact local water service providers to review water rates							Facility Energy Manager	GF

2. Demand Side

a. Building assessments will be completed at each DHHS institution to identify the condition of buildings including the age, type, and condition of the building equipment and lighting. These building assessments will serve as the basis for identifying building needs, developing scope of work for projects, developing estimated project costs, prioritizing project needs, and for requesting and obtaining funding to complete the projects and realize reductions in energy and water consumption.

b. Facility Maintenance staff at each institution will make the effort to identify potential energy and water conservation improvement opportunities by evaluating the existing HVAC control system including considering the following:

i. Time of day/night setback sequences.
ii. Chilled water and hot water set point optimization.
iii. Air handling unit (AHU) set point optimization.
iv. Outdoor air damper operation (closed when building is not occupied)
v. General verification of the operation of the building control system.
vi. Installation of variable speed drives.

Past 12 Months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Broughton Hospital – Gym Upgrades					$945,000		Division of Property & Construction	RR
Caswell Center – Boiler Addition at Parrott & Byrum Buildings					$1,000,000		Division of Property & Construction	RR
Caswell Center - Cooling Tower Replacement					$460,000		Division of Property & Construction	RR
Dorothea Dix Campus – Cooling Tower Repairs					$67,000		Division of Property & Construction	RR
J. Iverson Riddle Developmental Center – Replace chiller serving Spruce Building					$140,000		Division of Property & Construction	RR

Murdoch Developmental Center – Infirmary, Medical Clinic & Dental Clinic HVAC Upgrades					$3,617,000		Division of Property & Construction	RR
O'Berry Neuro Medical Treatment Center – HVAC Upgrades					$1,838,000		Division of Property & Construction	RR
O'Berry Neuro-Medical Treatment Center – ELC-1 Building Alterations					$6,923,000		Division of Property & Construction	RR
R.J Blackley: Building 24A Chiller Replacement					$369,000		Division of Property & Construction	RR
Walter B. Jones ADATC – Units 4, 5, & 6 Heat Pump Replacement					$189,000		Division of Property & Construction	RR
WorkSource West – HVAC Upgrades to Old Farm Colony Building					$376,000		Division of Property & Construction	RR

Next 12 Months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Lighting replacement with LED fixtures – Multiple facilities.					$250,000		Division of Property & Construction	2020 R&R
J. Iverson Riddle Developmental Center – Mulberry Building Domestic Water Heater Replacement					$74,000		Division of Property & Construction	2020 R&R

J. Iverson Riddle Developmental Center – Willow Cottage Replace Domestic Water & Sewer Piping					$210,000		Division of Property & Construction	2020 R&R
John Umstead Campus – Building 27A – HVAC Upgrades					$236,000		Division of Property & Construction	2020 R&R
Julian F. Keith ADATC – Dorms 1 & 2 Building Upgrades					$2,000,000		Division of Property & Construction	2020 R&R
Julian F.Keith ADATC – Activities/ Gym Building A/C Unit Replacement					$75,000		Division of Property & Construction	2020 R&R
O'Berry NMTC – Administration Building HVAC Upgrades					$355,000		Division of Property & Construction	2020 R&R
O'Berry NMTC – Window Replacement at ELC-2					$457,000		Division of Property & Construction	2020 R&R

The DHHS Utility Report showing energy and water usage and associated costs is included as a separate attachment. Note the following regarding the DHHS Utility Report:

1. The Special Care Center is Longleaf Neuro-Medical Treatment Center located at 4761 Ward Boulevard, Wilson, NC 27893.
2. The John Umstead Hospital data includes the R.J. Blackley Alcohol and Drug Abuse Treatment Center (ADATC) located at 1003 12th Street, Butner, NC 27509.
3. The Central Regional Hospital data includes the John Umstead Hospital (and R.J. Blackley ADATC) data starting in 2010-11.
4. The Dorothea Dix Hospital includes the Governor Morehead School starting in 2007-08.
5. The Vocational Rehabilitation combines both Work Source East located at 902 Corporate Drive, Goldsboro, NC 27534 and Work Source West located at 200 Enola Road, Morganton, NC 28655.

Confirmation:

This Strategic Energy and Water Plan is approved for the NC Department of Health and Human Services by its authorized representative, Luke O. Hoff, PE, Director of the Division of Property and Construction.

Approved: DocuSigned by: Luke Hoff 33CA902BBA3D4A1... Date: 8/28/2020

North Carolina Department of Information Technology (DIT)

Strategic Energy Management Plan

Measure, Track, and Reduce Energy and Water Consumption at Data Centers (EDC/WDC)

NCDIT-DSC-IOEDC / WDC – 0070

Version 0.1

July 2, 2020

Prepared for

NC Department of Information Technology

P.O. Box 17209, Raleigh, NC 27619-7209

Prepared by

Department of Information Technology Infrastructure Operations

Western Data Center

P.O. Box 17209, Raleigh, NC 27619-7209

Executive Summary

The DIT Eastern Data Center facility located at 3700 Wake Forest Rd, in Raleigh, NC, is nearly 40 years old and has housed the State's primary data center for about 29 years. The DIT Western Data Center is 13 years old and has taken on an increasing server load as it has transitioned away from being primarily backup and recovery. It is now a big part of agency consolidation efforts.

Both locations are open 24 hours per day, 365 days per year. At the EDC there typically are about 400 employees working from 8 am till 6 pm Monday through Friday, 30 employees on second shift Monday through Friday, and 20 employees third shift Monday through Friday. Approximately 10 employees are on site for 24 hours per day on the weekends and holidays. At the WDC there are about 34 total employees counting security and janitorial. There are typically about 12-13 employees onsite between 8am and 5pm with the rest covering the other shifts and weekends.

The nature of DIT's Data center facilities differs from most State buildings in that the energy consumption is constantly variable depending on the number of Servers, Network, and other types of Information Technology equipment currently in use. DIT offers numerous IT services supported by the Data centers to the other State Agencies. Much of the IT equipment which is used by these services are in the Data centers. Floor hosted options are also offered to the agencies where they utilize a spot on the Data floor with a DIT supplied rack, power, and cooling. Customers can also supply their own racks/cabinets if desired. The agencies need's change over time and is generally an upward trend from a power consumption view.

Energy Consumption based on square footage does not give an accurate representation of the efficiency of a Data center. The industry standard for Data center efficiency is Power Usage Effectiveness (PUE). That is the ratio between the Total building load and the IT load. The best way to increase PUE is to maximize the amount of IT equipment served and lower the energy consumption of the HVAC and lighting systems. Maximizing the PUE is very much dependent on the other State agencies participation in using more DIT services and/or bringing in more hosted equipment. That said, more equipment being brought in increases our energy consumption per square foot. We could become vastly more efficient and yet be no closer to reaching the 40% energy reduction per sq foot.

To get to a point where energy per sq foot is somewhat useful both the Eastern and Western Data Centers would need to be full. This would have to happen to even get a viable baseline. Again, since we are serving other State agencies, DIT has limited ability to fully utilize all the power and floor space available. An example would be an agency that pays for seven racks and only uses four of them with the others held for future growth. On a floor space basis, the Data center utilization is about 50%.

Energy and Water Data Management: WDC Facilities began using spreadsheets to monitor water and diesel fuel in 2009 and Electricity in 2015. Annual data for cost and usage for electricity, fuels and water have been reported to the NC Energy Office since 2007-08 when the WDC was first built. The EDC has been reporting to the energy office since it was required. There will be a renewed focus on monitoring energy consumption going forward. From the meter all the way down to equipment level at both data centers. This will allow us to find the areas we need to concentrate on. We hope to get a combined PUE chart for both data centers in the coming year.

Energy and Water Supply Management: Electric, Water and Fuel bills are reviewed monthly and abnormal usage is investigated. The Facility Manager's meet with Duke Energy representative's at least once a year to review rates and anything that may affect each Data Center.

Equipment and Building Efficiency: Regular documented equipment maintenance enables the equipment to run as efficiently as possible. Walls and windows are resealed as needed.

Existing Conditions: The EDC is a 94,343 with about 15,000 sq ft. of data floor with the rest being office space, warehouse, and shipping. Two Carrier Air Handlers. We have three Trane Chillers (each at 500 tons), 1 Rheem Round 120 Gallon Tank and Rheem Round 50 Gallon Tank for the building HOT water.

Novar Controls-for all HVAC points. Three 2500kw Caterpillar generators.

The WDC is a 53,000 sq ft. Data Center with two 500-ton and one 50-ton Trane Chillers, three 2500kw Caterpillar generators, and three 750kw Emerson UPS. The building is designed to support the IT operations of the 15,000 sq ft. data floor, office space, small warehouse and receiving.

The Department of Information Technology will strive to meet the goals set forth in EO 80. We will work toward conservation of energy and water resources at all our locations by creating, implementing, and following an effective Energy and Water Management Plan. The objective of the Plan is to guide the fiscally and environmentally responsible usage of valuable resources in accordance with state legislation, while striving to ensure a safe environment that provides an acceptable level of comfort for staff, and visitors.

FY 2019/20 Usage

Factors

Several unusual factors came into play in 2020. The Covid-19 Pandemic has greatly reduced onsite work at the EDC with hundred employees working from home. IT personnel at the WDC are also working predominantly from home, however at the WDC this is offset by multiple vendor personnel being onsite with the fiber project.

The WDC Fiber project required 3-4 weeks of intense under the floor work in the Data room. During this time, large number of tiles were removed to perform the work. Our fan gallery fans were running at full capacity 8-9 hours a day during this time. A 40-50% increase over normal.

The WDC Building Management System was upgraded over three phases starting in February. During this time, the main controller and software, AHU 1-2 controllers and the Chiller Plant controllers were replaced. Over the course of the upgrade, both 500-ton chillers were run at the same time multiple times for several hours for testing. Other Air handlers and equipment were run more than usual as well. Spring is the time of year we would typically see a reduction in power consumption.

Due to these factors the WDC saw a very slight increase in electrical consumption this year. The EDC saw a decrease in electrical consumption at least partially due to the pandemic. Both data centers saw a large decrease in Diesel fuel consumption. Primarily due to better weather conditions over the previous year and reduced run times at the WDC. We also went to a once a month schedule for several months due to the pandemic. Winter weather and Hurricanes can greatly increase the amount of run time needed.

BTU's per square foot were down significantly this year. 318,196 vs 360,839.

Metric	Baseline 2002-03	Current 2019-20	% Change
Gross Square feet	94,343	163866	74%
Utility cost	$362,255	$1,204,029	232%
Btu per square foot per year	272,914	318,196	17%
Cost per million Btu	$13.67	$20.62	51%
Water gallons per square foot	90	72.51	-19%
Water cost per thousand gal	$1.23	$10.64	765%

2019/20 updates

- We are now running three mechanical cooling units in the UPS room at the WDC rather than four. Cooling is still maintained within recommended temperature and humidity for the UPS.
- The Bi-weekly generator test runtime was reduced by 20 minutes at the WDC and has contributed to lower fuel consumption this year.
- Water heater for eyewash station shut off. Not needed to maintain water within OSHA specifications.
- 1000 LED plug and play Philips bulbs were purchased for installation in the Data room during the 20-21 year. Installation is underway.
- All the lighting at the EDC was replaced with LED and completed during the 19-20 year.
- Computer room air conditioners were replaced at the EDC during the 19-20 year with new more efficient units.

- Lag Chiller setting at the WDC was reduced from 1 hour to 30 minutes. Lag chiller typically runs 3-4 times per year during testing and sometimes due to power outages. The reduction is the amount of time it will run after temps are normal.
- During the WDC BMS upgrades it was found that we can run the AHU chilled water loop at a higher pressure and lower gallons per minute with greater cooling efficiency.

Goals for 2020-21

Focus Areas

78% of the WDC's building load is the Chillers and UPS server and network load. The remaining 22% is Pumps, Air Handling, heating, and lighting load. 50% of the load is the servers and networks. Managing the servers and networks with efficiency in mind must be a priority. When new equipment is purchased, high efficiency must be part of the purchase criteria. Agency hosting customers must be part of the process as well.

We need a renewed focus and buy in from upper management and HR to reduce energy usage by adopting a personal appliance use policy. Space heaters in particular are inefficient and can be a fire hazard. Reduction in energy usage by implementing computer power management for all ITS personal computers (where applicable). Purchasing energy efficient computer equipment, Servers, storage units, tape drives, where applicable. We need continued analysis of both Data Centers to potentially lower energy usage by increased efficiencies.

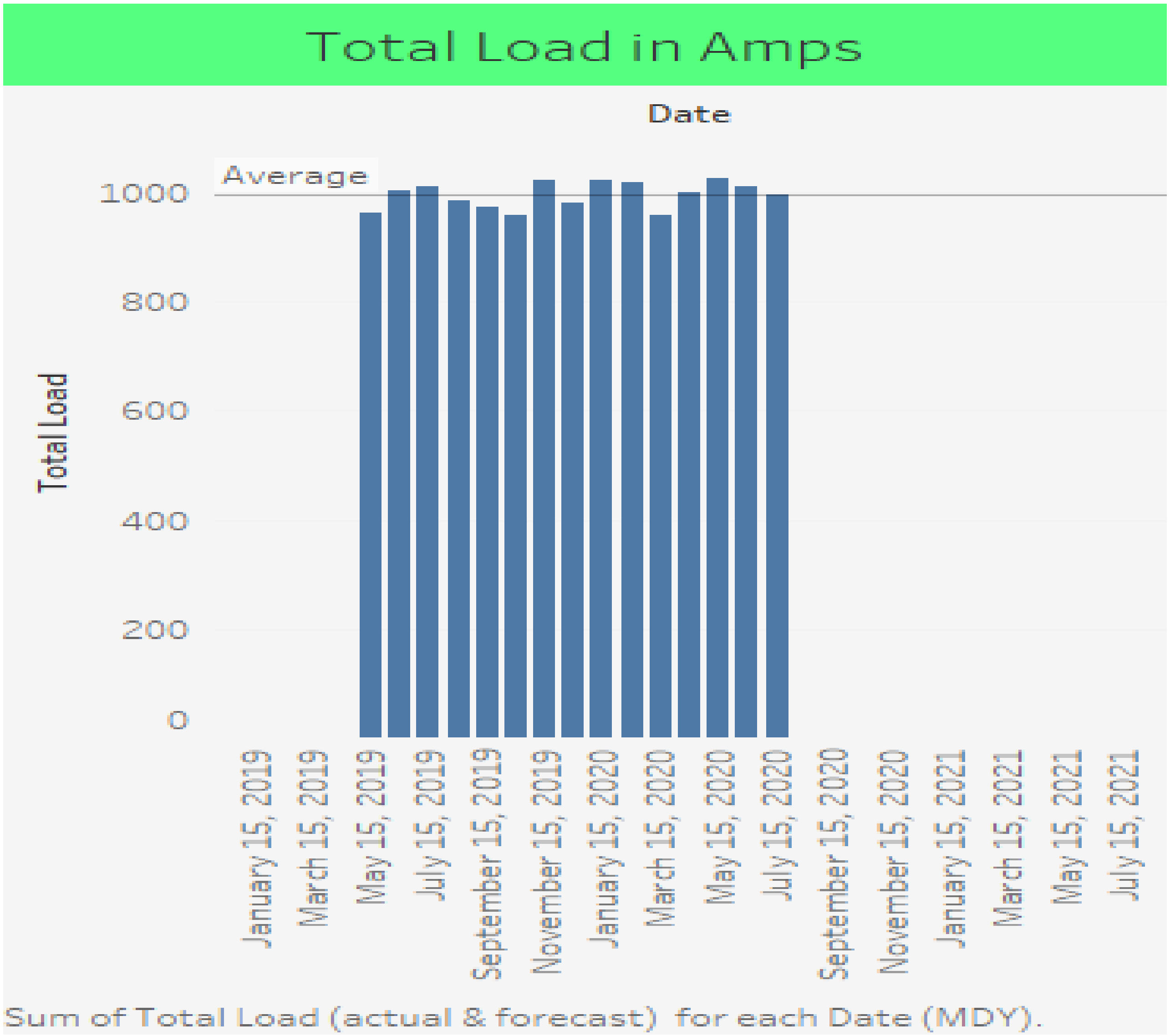
- Continue with energy efficiency training opportunities.
- EDC to have the electrical distribution project engineering study done this year. Though it is not specifically an energy reduction project, when the project is completed, we expect greater electrical monitoring capabilities, higher efficiency equipment and reliability.
- Complete the Data room LED installation at the WDC.
- Continue installing LED's in the rest of the WDC as the fluorescents fail.

- Start monitoring the PUE of the EDC like is being done at the WDC. With the current setup at the EDC it will be cumbersome to start, but after the electrical upgrades are done it should be much easier.
- Create a combined Data center PUE chart.
- Sixteen new server cabinets installed in June 2020, were equipped with smart power bars that will allow control and monitoring down to the outlet level. Upgrades in the future for all the existing cabinets is in the planning stages. (funding dependent)
- Continue monitoring both water and electrical metering to ensure it is correct and meet with Duke energy representative twice per year to stay abreast of anything that may affect our rates or service.
- Investigate water consumption at the EDC. It is still substantially higher than the EDC even with most of the IT staff working from home.

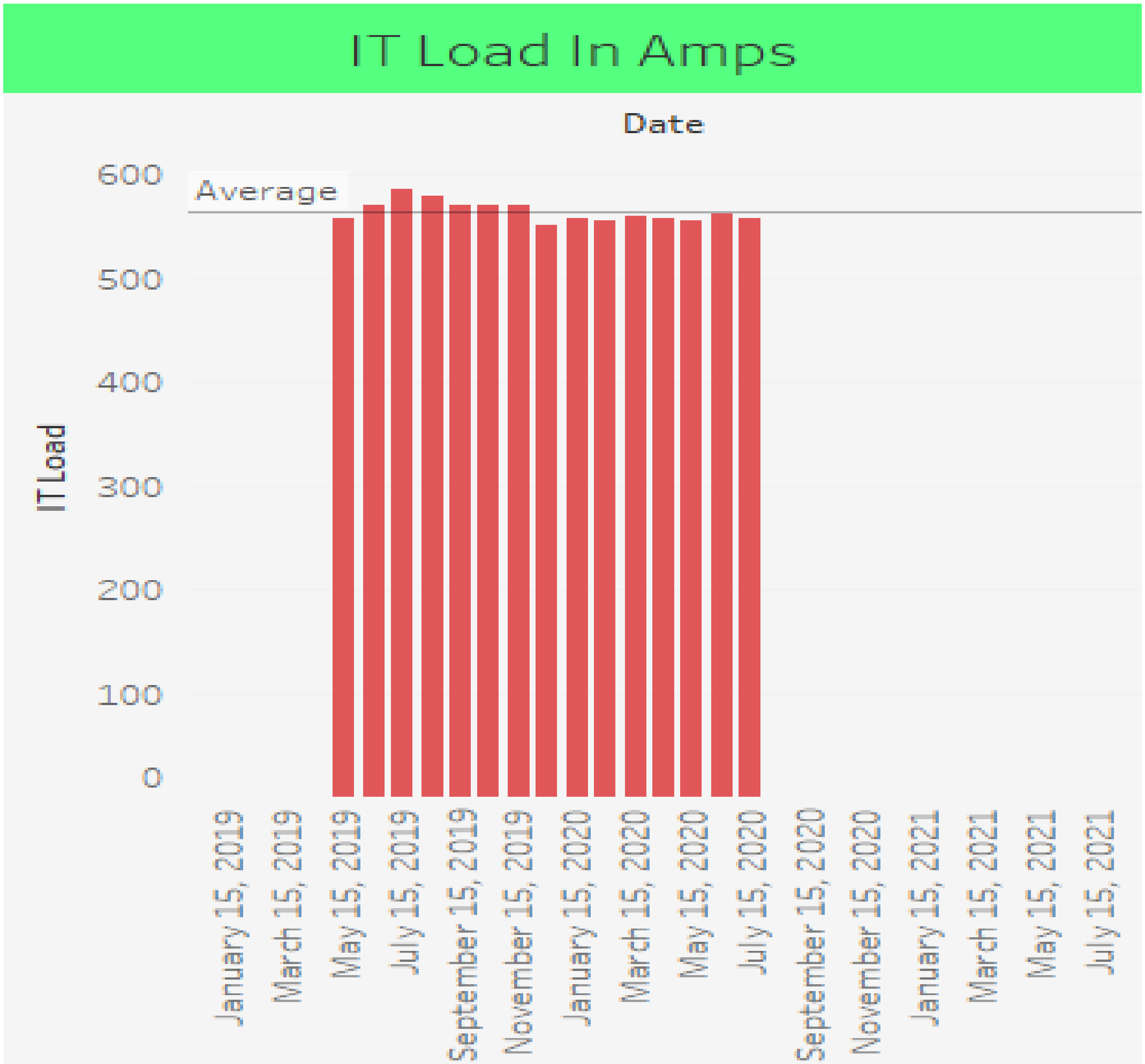
Future projects

- Work on potential funding for a more efficient third chiller at the WDC.
- Scheduled replacement of the existing UPS units at the WDC with more efficient units. 85% vs 93-97%. Two to three years out.
- EDC to complete the electrical distribution project. Funded.
- Enclosed cold aisles at the WDC. Not funded. Need to work up potential savings.

Graphical Representation of the WDC Electrical loads



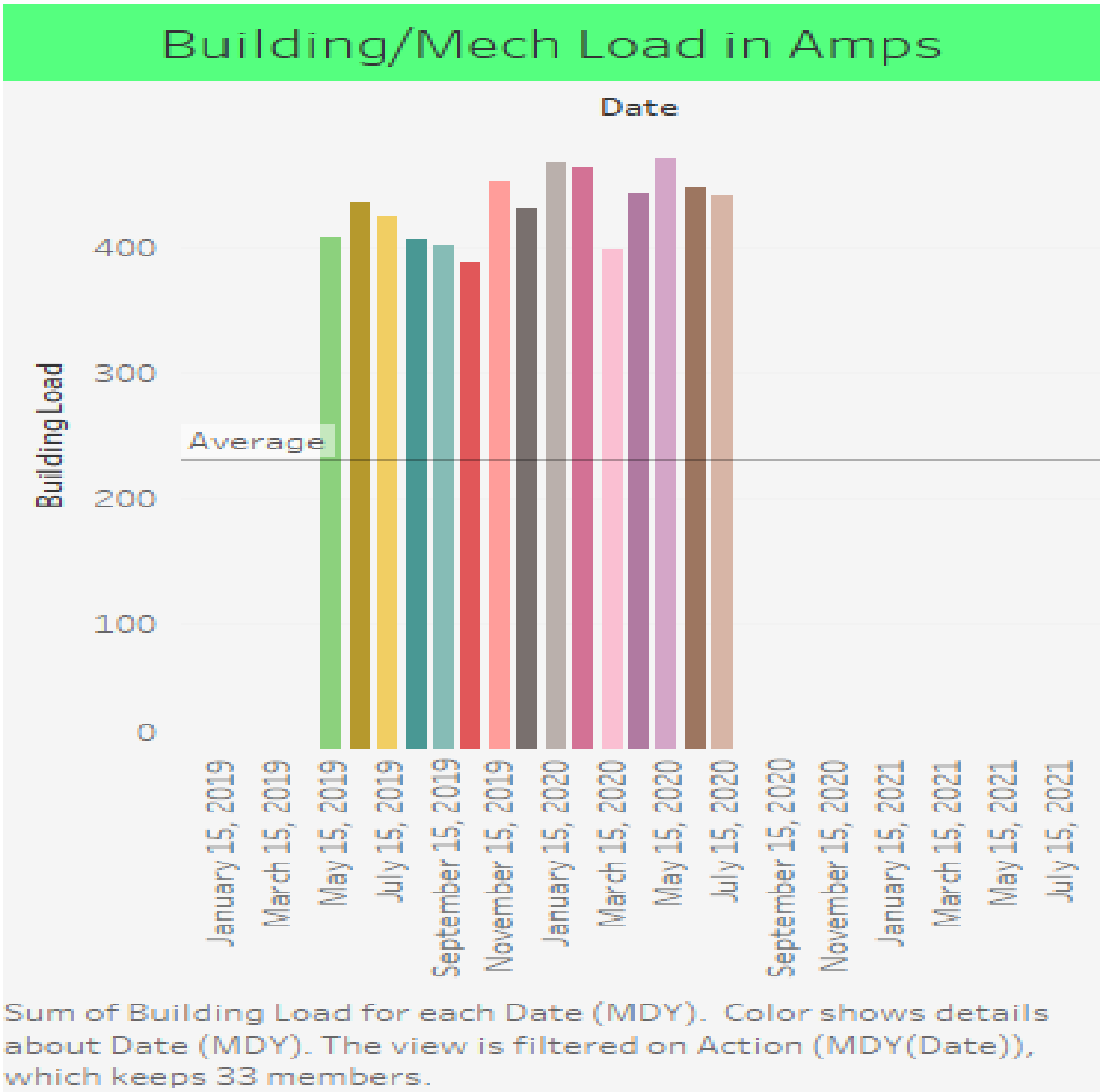
This May and June year over year were likely higher due to the fiber and building management system projects and upgrades.



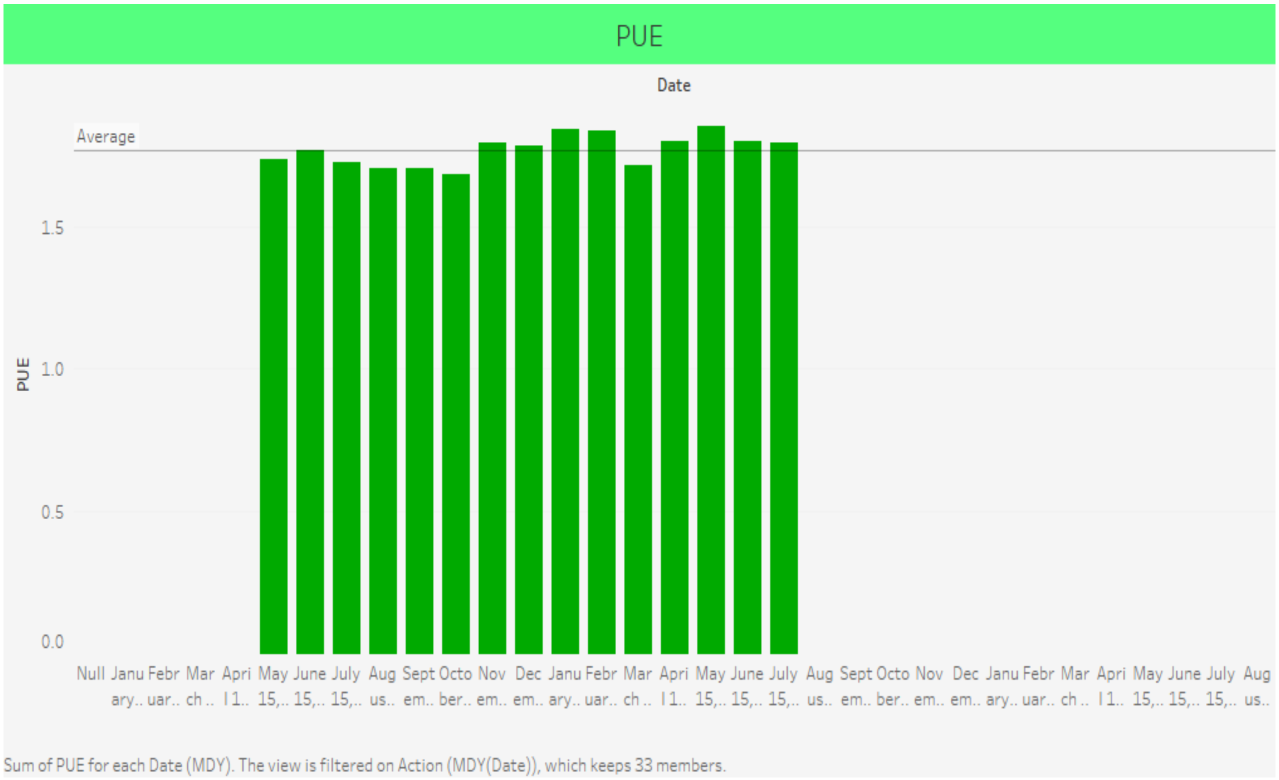
Sum of IT Load for each Date (MDY). The view is filtered on Action (MDY(Date)), which keeps 33 members.

IT load has trended downward due to changes in the amount of equipment in the Data room.

Refreshes and virtualization account for the trend.



Mechanical Cooling loads trended up during the spring and summer due to the Fiber and BMS projects.



Power usage effectiveness (PUE) is the industry standard for Data Center efficiency monitoring. It is the Total building energy/Total IT loads. The idea is that the IT load should be the predominant consumer with the rest of the building loads as low as possible. IT loads that come into DIT's data centers can be handled more efficiently and helps the other state agencies lower their energy consumption.

The WDC PUE has been as low as 1.68 to a high of 1.85 this past year and has trended upward in recent months due to the lower IT load and the spring/summer projects.

Progress

Consumption has dropped to 17% over 02/03 btu/sf levels. This is the best we have been since 05/06. Note: In the early 2000's DIT was a much smaller agency that did not house the number of servers and IT equipment that we do today. That fact greatly contributes to the difficulty in achieving EO80 requirements, however that in no way prevents us from working to reduce consumption as much as we can while maintaining Data center reliability.

	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
02/03		$3.73	$13.67		272,914			$1.90		58.03	
03/04	-$13,911	$4.17	$14.72	8%	282,930	4%	-$1,504	$1.69	-11%	67.46	16%
04/05	-$36,880	$4.30	$14.31	5%	300,237	10%	-$1,551	$1.71	-10%	67.63	17%
05/06	-$83,065	$5.09	$15.44	13%	329,943	21%	$85,297	$15.63	722%	0.17	-100%
06/07	-$146,910	$6.09	$16.60	21%	366,747	34%	$53,728	$9.88	420%	0.37	-99%
07/08	-$123,483	$5.58	$17.37	27%	321,172	18%	$94,500	$12.58	562%	7.03	-88%
08/09	-$285,594	$6.74	$17.92	31%	375,794	38%	-$11,655	$5.46	187%	71.82	24%
09/10	-$336,266	$7.03	$18.24	33%	385,416	41%	$8,572	$7.43	291%	50.99	-12%
10/11	-$439,696	$7.72	$18.45	35%	418,371	53%	-$4,351	$7.54	297%	61.56	6%
11/12	-$368,901	$7.48	$19.15	40%	390,467	43%	-$4,246	$8.18	331%	61.20	5%
12/13	-$336,030	$7.40	$19.59	43%	377,583	38%	-$1,587	$8.21	332%	59.21	2%
13/14	-$298,519	$7.41	$20.48	50%	361,852	33%	-$9,858	$9.39	394%	64.44	11%
14/15	-$283,613	$6.93	$19.04	39%	363,819	33%	-$13,509	$9.44	397%	66.77	15%
15/16	-$338,243	$7.91	$21.42	57%	369,266	35%	-$29,807	$10.18	436%	75.90	31%
16/17	-$252,457	$7.16	$20.59	51%	347,729	27%	-$24,755	$10.42	448%	72.53	25%
17/18	-$254,542	$6.87	$19.49	43%	352,622	29%	-$20,913	$10.64	460%	70.03	21%
18/19	-$294,877	$7.39	$20.47	50%	360,839	32%	-$37,215	$11.39	499%	77.97	34%
19/20	-$153,011	$6.56	$20.62	51%	318,196	17%	-$25,726	$10.84	471%	72.51	25%

NC DIT Western Data Center
Energy and Water Management Plan Mandate

The Department Heads will review progress and results annually and will support staff attendance at training in energy and water management.

Our tracking measures will be the following Key Performance Indicators (KPI):
Total Energy Use Btu per Square Foot per year
Water gallons per Square Foot per year
Power usage effectiveness

Commitment

We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility. The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

Strategic Energy Management Plan Mandate- Commitment

I have read and support the Strategic Energy Plan for my Organization Implemented this __ day of ____

Facilities Manager DocuSigned by: Tony Brackett 064DCE1867E9474... Date 8/26/2020 | 1:26 PM
____

Operations Director DocuSigned by: Henry Taylor BB7BB0435C254C8... Date 8/26/2020 | 2:06 PM
____

Chief DSCIO DocuSigned by: Susan Kellogg FE3F24D45A644DE... Date 8/28/2020 | 8:07 AM
____

North Carolina Department of Military and Veterans Affairs

Agency Utility Management Plan

2019-2021

Prepared by Cecil Holt, DMVA Energy Manager
8-29-2020
With Military Installation Information provided by:

Paul Berry
SgtMaj, USMC (Retired)

Robert Johnson
SgtMaj., USMC (Retired)

Program Development Installation Coordinators
NC Department of Military and Veterans Affairs

Purpose

To provide Secretary Hall of the North Carolina Department of Military and Veterans Affairs & Department of Environmental Quality information on Executive Order No. 80.

"The North Carolina Department of Military and Veteran Affairs is the newest state government agency and we are dedicated to helping our veterans and active duty men and women access the programs, benefits and resources that they earned when they took the oath and answered the call to service. Our staff is committed to providing the highest level of service, responsiveness and integrity in keeping with the principles and values of this state and nation that our military and their families deserve. "

Larry D. Hall, Secretary of Department of Military and Veteran Affairs

Overview

- DMVA is a State agency that assists with the management of 4 military Skill Care Nursing Homes housing 449 veterans and are currently in the construction phase of 1 - 120 Bed Home & plans to build a 6th Home to provide additional housing for veterans in the state.
- North Carolina has one of the largest military footprints of any state in the country, representing three out of the four branches of service and totaling 129, 049 in 2016. Military and defense industries are the second largest employers in our state, and the military has an economic impact of $66 billion annually. The military bases located in North Carolina are major drivers in our communities, allowing families and business to thrive through the synergy and partnerships that have developed between local and state government, military and defense sectors, and local businesses throughout our history.

Utility Management Plan Goals

Department Veterans Affairs Nursing Homes

Salisbury State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System
- Add Light Diming functions to Resident Rooms.
- Investigate how to monitor utility consumption on site

- Will request Design Proposal to add Isolation Wing in response to COVID Pandemic, with Negative Pressure Equipment Features to Home in effective yet energy efficient manner.
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.

Fayetteville State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System
- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request Design Proposal to add Isolation Wing in response to COVID Pandemic, with Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Black Mountain State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System
- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request proposal to add Isolation Wing in response to COVID Pandemic, Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Kinston State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System

- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Existing Shingle Roof Replacement will be with Metal
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request proposal to add Isolation Wing in response to COVID Pandemic, Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Kernersville State Veteran Home (Construction Phase)

- In response to COVID Pandemic, a Change Order will was approved to add Isolation Wing with Negative Pressure Equipment features to Home in effective yet energy efficient Specification and Design.
- Being built to current Energy Codes.
- DMVA did participate in the Duke Energy New Construction Energy Efficiency Design Assistance Program provided by the Weidt Group.
- Investigate how to monitor utility consumption on site

Raleigh State Veteran Home (Proposed)

- If funding is approved the intent is to have a Solar System as a Base Bid program item.
- Investigate Green Roof System as a alternate program item.
- Will be designed & built to current Energy Codes.
- Will participate in the Duke Energy New Construction Energy Efficiency Design Assistance Program provided by the Weidt Group.
- Investigate how to monitor utility consumption on site

Department of Military & Veterans Affairs Cemeteries

Western Carolina State Veterans Cemetery

- Seek funding to install an energy efficient irrigation system in place of staff manual watering system.
- Research funding and options to retrofit lighting to LED fixtures.

Coastal Carolina State Veterans Cemetery

- Seek funding to replace existing irrigation System with an energy efficient system.
- Research funding and options to retrofit lighting to LED fixtures.

Sandhills State Veterans Cemetery

- Seek funding to install an energy efficient Irrigation system in place of staff manual watering system.

- Research funding and options to retrofit lighting to LED fixtures.

Military Installations in NC

"The chief priority of the Department of Defense (DoD) energy policy is to ensure the mission readiness of the armed forces by pursuing energy security and energy resilience. In today's technology-dependent environment, energy is inextricably combined with the Department's missions, from the directly employed weapons systems to the installations and systems that support missions around the globe. In this environment, energy resilience, which enables the capabilities of weapons platforms, facilities, and equipment, is a critical investment that must be part of the Department's research, acquisition, operations, and sustainment conversations."

Camp Lejeune

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Coast Guard's Base Support

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Fort Bragg

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Seymour Johnson Air Force

- Site visits or teleconferences to connect with the energy manager on site to determine installations strategy energy security and sustainability goals.
- Collaborate to share best practices and knowledge gained from energy and water initiatives

The attached following documents display the efforts the installations are taking in regards to Energy and Energy Resilience Plans. Provided by

a. Department of Defense Operational Energy Strategy Implementation Plan. This document provides the overarching guidance to the uniformed service components. Each uniformed service component then builds their own Energy Plan/Strategy.
b. Depart of the Navy (DoN) Installation Energy Resilience Strategy. This document provides guidance and direction to the Navy and Marine Corps on how to develop each installation energy plan. This strategy provides further guidance

and direction on the proper use of energy when the uniformed are training and during combat operations. The Army, Air Force, and Coast Guard have very similar plans.

c. Marine Corps Installations East (MCIE) Energy Plan. This is a great example of a local plan here in NC. Camp Lejeune and Marine Corps Air Station Cherry Point both recently converted from coal fired hot water plants to natural gas. Every Battalion and Squadron level command has an Energy Manager. Their duties direct them to monitor the energy consumption both in garrison and during field training environments. Social media is used heavily to educate all personnel on how to properly use and conserve energy. An example if when there is a major holiday assigned personnel ensure all lights and office equipment are tuned off. These efforts have proven to be big cost savers over time. Military Ocean Terminal Sunny Point (MOTSU), NC is energy independent. They have a state of the are solar farm that provides most of their energy. I have requested details from them about this project and I will share it with you.
d. MCIE Energy and Water Strategy. I was at this command when this strategy was written. This is an example of a well written plan that is easy to implement and monitor.
e. Joint Land Uses Study Seymour Johnson Air Force Base and Dare County Range. These studies have also taken place around Camp Lejeune, Cherry Point, Ft. Bragg, and MOTSU. One of the outcomes of protecting land around military installations is Energy Development.

A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis is currently taking place with the NC Military Installations.

Attached are the following documents that best display the efforts the installations are taking in regards to their Energy and Energy Resilience Plans.

a. Department of Defense Operational Energy Strategy Implementation Plan. This document provides the overarching guidance to the uniformed service components. Each uniformed service component then builds their own Energy Plan/Strategy.
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A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis is currently taking place with the NC Military Installations. This will be after your 1 September deadline but will be shared for situational awareness.

NC Department of Military & Veterans Affairs
Agency Utility Management Plan

- The NC Department of Military & Veterans Affairs recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and Water management is the responsibility of the staff at each facility, which will be guided and supported by the Energy Manager Designee for NC DMVA.
- The Department of Military & Veterans Affairs has implemented an Agency Utility Management Plan.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.
- The Department Secretary's staff will review progress and results and will support staff attendance at training in energy and water management.

Agency Utility Management Plan Goals

- As required in Executive Order 80, NC DMVA will support efforts to reduce by 2025 total energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels and reduce state-wide greenhouse gas emissions to 40% below 2005 levels.

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Military and Veterans Affairs. The plan, as presented, supports the reduction goals in Executive Order 80. Implemented this 1st day of September 2020

Energy Manager

Larry D. Hall, Sec.
Department Secretary

Appendix A

Sample Utility Management Plan

2019-20

Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect EE strategy toward 40% reduction in Btu/gsf.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2019-2020 Planned Activities	**Expected Measurement**	**Assigned To**	**Occurrence**
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Monthly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager and staff	Due March 1, 2019, thereafter October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	(add dates of training)
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager and staff	May, 2019
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager and staff	May, 2019
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager	Quarterly

2019-2020 Planned Activities	Expected Measurement	Assigned To	Occurrence
Track utility data	Record monthly utility data for annual utility report to submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year

2019-20

Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Create a schedule for projects to be implement during the fiscal year
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	Expected Measurement	Assigned To	Occurrence
Research lighting retrofit or replacement opportunities in Retirement Homes	Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.	Energy Manager	Ongoing
Investigate feasibility of Solar Powered Water Heater System	Determine if installation of solar powered water heating system feasible.	Energy Manager and Agency Staff	Ongoing
Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.	Determine if lighting can be upgraded on pole lighting by utility company	Energy Manager and Agency Staff	Ongoing
Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System	Determine which units can be retrofitted or upgraded to more energy efficient units	Energy Manager	Ongoing
Investigate how to monitor utility consumption on site	Determine the best method to track utility data	Energy Manager	Ongoing
Site walkthrough with State Energy Office	Look for additional low/no cost projects	Energy Manager and staff	Ongoing

Educate and engage employees in best practices	Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.	Energy Manager and staff	Ongoing
Building New Retirement Homes to current Energy Codes.	Design and build new facilities to be energy efficient.	Energy Manager and staff	Ongoing
Participate in Duke Energy New Construction Energy Efficiency Design Assistance Program	Participate in the program provided by the Weidt Group.	Energy Manager and staff	Ongoing
Lighting retrofits at cemetery.	Research funding and options to retrofit lighting to LED fixtures.	Energy Manager and staff	Ongoing

NORTH CAROLINA
DEPARTMENT OF
NATURAL & CULTURAL
RESOURCES

Strategic Energy and Water Management Plan
North Carolina Department of Natural and Cultural Resources

Prepared by:

NC-DNCR Energy Management Team
109 East Jones Street
Raleigh, North Carolina 27601
August 2020

PURPOSE

The Department of Natural & Cultural Resources finds that public buildings can be built and renovated using sustainable, energy efficient methods that save money, promote environmental sustainability, and make employees more productive. The main objective of this plan is to develop a strategic initiative which will evaluate departmental energy and water usage, identify inefficient buildings and systems, and determine measures to correct inefficiencies, establish corrective action priorities, identify funding sources, implement corrective actions, and ensure that corrective action results meet or exceed performance specifications. The goals of the Department's plan should create buildings that at a minimum, meet the specific performance criteria and goals for sustainable, energy and water efficiency as mandated by senate bill 668 and Executive Order No. 80. Our plan will be considered successful when sustainable, energy efficient buildings avoid depleting the resources of energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create buildings that are livable, comfortable, safe, and productive.

OVERVIEW

The Department of Natural & Cultural Resources spent $6,200,000 in FY 2017-18 on energy and water resources. A well-executed long-term energy efficient plan could result in cost savings of 10% or greater annually, which could lead to significant long-term operation cost savings.

The Department is responsible for the operation and maintenance of approximately 1,825 buildings per State Property Office. The Department's building inventory includes historic structures (primarily houses), museums, amphitheaters, administrative offices, support & maintenance buildings, the North Carolina Zoo, State Park facilities, Aquariums and the USS North Carolina Battleship. At least half of the buildings are more than 30 years old, with over 100 built before 1900. Only around 25 structures are larger than 20,000 gross square feet.

This plan will initially focus on identification of major energy and water consumers, which will most likely be existing major facilities (20,000 square feet or larger) with older less efficient systems. The Department will work closely with the State Energy Office and energy consultants to identify measures to correct major inefficiencies. It is anticipated that major renovations & upgrades will require significant funding. Low or no cost actions will be implemented as soon as possible at all facilities. A comprehensive energy & water efficiency awareness & training program will be established for employees. The Department will seek to train facility maintenance personnel on innovative and low-cost techniques to lower energy and water consumption for their specific site.

This plan will also implement sustainable, energy efficient standards for design and construction for new facilities, improvements in lighting systems, reduction of water usage, implementing high efficiency HVAC systems, utilization of energy conservation measures, and environmental sustainability.

FY 2020-2021 GOALS

- Reduce energy consumption per square foot towards the goal of a 40% decrease in comparison to FY 2002-2003 levels, consistent with Executive Order No. 80.
- Conduct informal energy audits on highest energy consuming facilities in the Department to identify energy cost saving measures to reduce consumption by FY 2020-21.
- Continual annual self-audit procedure and checklist for Departmental facilities to identify low or no cost energy saving initiatives to reduce consumption in FY 2020-21.
- Establish annual energy and water usage reporting form to more accurately collect data and determine seasonal trends. Conduct assessment and evaluation of individual sites and energy billing rate schedules.

DATA MANAGEMENT

Current base year for Department data is FY 2010-11. Goals for energy reduction are based on comparison to 2005 levels.

- Merge additional data for former Natural Resource sites (State Parks, Zoo, etc.) for the years before 2010-11.
- Project Cultural Resource sites for the years before 2010-11.
- Research data management options, such as bill paying services to ensure more accurate utility data.

NEW CONSTRUCTION AND RENOVATIONS

New construction of facilities, even at current minimum standards will perform at better btu/ft^2 levels than existing buildings in the department's portfolio.

- New Visitor Center and Museum at Fort Fisher State Historic Site (in design)
- New Underwater Archeology Building at Kure Beach (in design)
- New Addition to the Museum of History in downtown Raleigh (in design)
- New HVAC system at the Tryon Palace Main Building (completed 2018)
- South Mountains State Park Visitor Center, R-22 substitute refrigerant study
- Various Connect NC bond projects with State Parks
- Roof repair projects will include increased insulation value where applicable
- A third-party firm is conducting a study of the Department's largest energy users to investigate the feasibility of combining multiple sites into a Performance Contract.

OUTREACH AND SUSTAINABILITY

Energy Management will continue to focus on demand-side management by implementing low/no-cost conservation and energy efficiency measures first.

- Adopt best-practice strategies to reduce energy usage at NC-DNCR sites throughout the State
- Develop sustainability policies that emphasize reuse and reduction of consumables
- Support sustainability initiatives through electronic materials and signage at waste stations
- The DNCR Environmental and Energy Performance Committee meets monthly including members from each division in the Department.

ENERGY MANAGEMENT PLAN BUY-IN

GOAL to accomplish the following by the year 2025:
Reduce annual Total Energy Consumption by a minimum of 40% from a baseline established in fiscal year of 2002-03, consistent with Executive Order No. 80.

MEASURES
Our tracking measures will be: Total Energy Use in Btu per Square Foot per Year

COMMITMENT

- We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility, guided and supported by the Utility Manager and Utility Savings Initiative (USI) Liaison.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.
- The Division Heads will review progress and results and will support staff attendance at training in energy and water management.

DEPARTMENT OF PUBLIC SAFETY
CENTRAL ENGINEERING
Plan • Design • Construct

EXECUTIVE ORDER 80 ENERGY & WATER MANAGEMENT PLAN

Revision 1

SEPTEMBER 16, 2020

CENTRAL ENGINEERING
2020 Yonkers Road, Raleigh, NC 27699

Executive Summary:

GS 143-64 requires all agencies reduce energy and water *intensity* by 30%[1] by 2025. Governor Cooper's Executive Order 80 increases this requirement to 40%[2] by FY 2025-2026. NCDPS is struggling to attain these targets (see **Graph 1A** and **1B**) even though efforts have intensified substantially since FY 2017-2018 (**Appendix A**). NCDPS currently stands at an 19 % energy and 12 % water reduction compared to FY 2002-2003[3]. By comparison, the department *peaked at a 22% and a 23% reduction respectively in FY 2016-2017. The department's annual* water & sewer expenditure is about the same as electricity - and even higher for correctional facilities*. For this reason, the focus must be equally on energy and water reductions in intensity. A challenge to reducing intensities is that ~40% of correctional spaces are not air conditioned and lack sufficient security lighting; moreover, when NCDPS begins addressing these basic operational shortfalls, it will only serve to delay achievement of the targets.*

Attaining these targets requires aggressive action:

- Saving approximately 87 MMBTU every year for the next six years based on current usage intensity.
- This translates to investing approximately *$13.5M* a year in water and energy efficiency projects[4], or $81M over the next 6 years. Projects both funded and unfunded needed to attain these targets are provided in **Appendix B**. *Aggressive leak detection and repair could noticeably reduce overall project funding needs.*
- Hiring additional staff to manage these projects and properly maintain facility systems.
- Leadership buy-in and promotion of commission-based maintenance over break-fix.

Legislation like HB 1292[5] for cabinet agencies would accelerate these efforts. Several universities have taken advantage of this bill and have surpassed the desired 40% reduction in water & energy intensity.

Attaining these targets have tremendous tangential benefits:

- Improved security and safety of our Adult Correctional and Juvenile Justice officers and staff, and adult and youth offenders.
- Reduced deferred maintenance.
- Reduced maintenance requirements.
- Improved occupancy comfort (temperature and visual),
- Prolonged equipment life.
- 15% or better ROIs. *How many departments can pay for their salaries through their savings?*

Attaining these target reductions are challenging for several reasons:

- Insufficient energy management and maintenance staffing.
- Insufficient funding with energy and water efficiency projects competing with other Repair and Renovation needs such as leaking roofs, failing infrastructure and mechanical & electrical systems.

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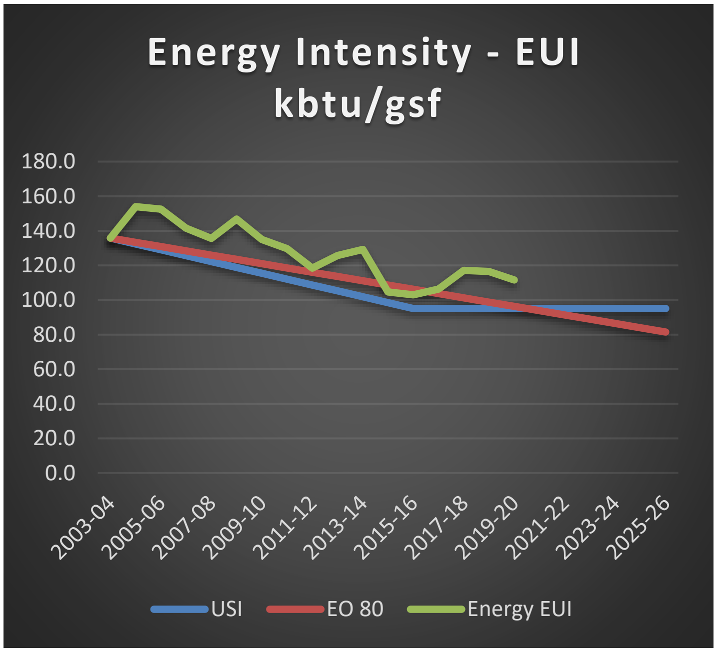
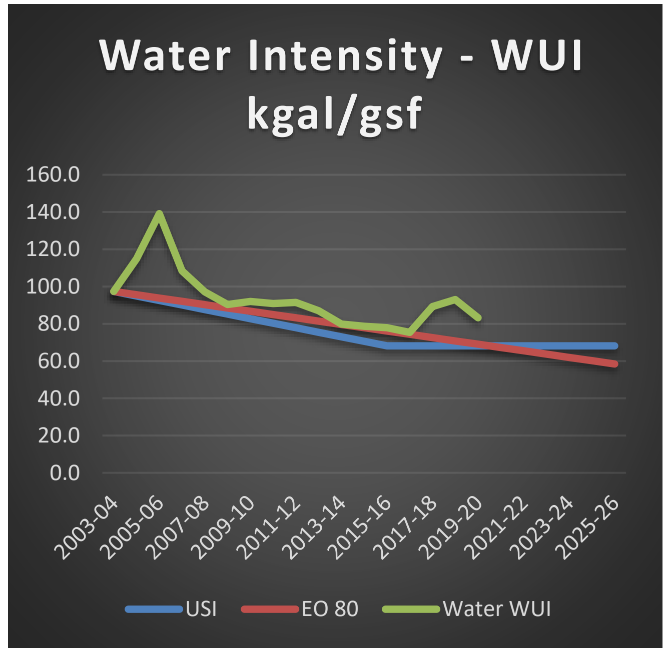
[1] Session Law 2008-203/Senate Bill 1946: Intensity is the energy and water use per square foot.
[2] Compared to our energy/water intensity (usage per gross square foot) in FY 2002-2003. See also Footnote 3.
[3] There is insufficient data to establish a FY 2002-2003 baseline. So, FY 2003-2004 is being used. See also Footnote 2.
[4] This is an "order of magnitude" estimate. Our current level of project investment is $1M a year, or around 10% of what is required.
[5] HB 1292 allows universities -but not other state agencies - to use energy efficiency savings from completed projects for new energy efficiency projects. Utility budgets are maintained at "pre-energy efficiency project" funding levels.

- No building management system (BMS) standards and insufficiently trained staff to proper manage these systems.



Graph 1A



Graph 1B

Accomplishments FY 2019-2020:

Funding:

Opt-Out funding peaked this year at close to $1.2 M. *This will decrease over time due to site closings and reduced energy usage.* From the inception of our program to present over $2.4M in credits have been received.

Analyses:

- NCDPS' utilities database, Capturis, issues "fatal exceptions" whenever usage increases by 50% as compared to the same month in the past year. Emails are faithfully sent to these facilities staff at these sites requesting investigation of these issues. Otherwise, uncovering excessive (outlier) energy/water outlier usage is like looking for a needle in a haystack. The latest (August 2020) version Energy/Water Analytics Dashboard now pinpoints sites trending in the wrong (or right) direction at-a-glance.
- Oil and Propane are commodities – not utilities. This data must be carefully extracted from the NCAS system. As of FY 19-20 propane bills are now entered into Capturis partially simplifying the task. Fuel Oil bills still require careful review.

Finally, rate analyses (electric and third-party natural gas) are now on an annual review to always ensure the most cost competitive rates are used.

Staffing: Energy Management: The team has increased in size from 1 full time equivalent employees (FTE[6]) to 2.75 FTE with the hiring of a project manager for exterior lighting projects and a ¾ time college intern. These positions are temporary employees funded through Opt-Out credits and subject to disruptions created by frequent turnover. Adult Corrections (AC) is in the final stages of hiring an Energy & Sustainability Manager for the Department of Prisons. These hires will accelerate our interior lighting projects, allow us to formally develop a water leak detection, and, maintenance-based commissioning (MBC) program.

- Project Management: Additional support is provided on a 'when available' basis from the Central Engineering project management team. Over the past 12 months, four Small Business Projects have been completed by a project manager, yielding the equivalent of a ¼ FTE for the Energy Program.

[6] We cannot hire full time staff. Opt-Out funds are being used to hire additional staff from Temporary Solutions to develop sufficient bandwidth to execute more projects. However, temporary employees have little incentive to remain in temporary positions.

Projects:

Exterior Lighting: Since FY 2017-2018 over $1.9M has been spent and over 1,180 perimeter and 725 wall pack LED fixtures installed at our Correctional and Juvenile Justice facilities. 23 sites have been improved by these projects and of these 6 sites are completely retrofitted with LED exterior lights.

Interior Lighting: Since FY 2017-2018 over $506k has been spent on interior LED lighting retrofits for 21 sites.

Four sites have had comprehensive audits and retrofits under Duke Energy's Small Business Energy Savers (SBES) program. NCDPS spent $190k to receive a matching $285k in rebates as Duke covers 60% of the retrofit cost under this program.

Building Management Systems (BMS): Phase I of the BMS Design Guidelines is complete and being implemented on current and new projects. The design for upfitting Nash CI's BMS in accordance with the new BMS design guidelines is complete.

Water Leaks: The average age of our facilities is over 50 years and water leaks are a major issue. In FY 2018-2019 over $600k in water and energy savings occurred at Nash CI once leaks were repaired. Another major water leak at NCCIW is under investigation with repairs anticipated by November 2020.

Programs: All lighting purchases must now be approved by Central Engineering. This ensures we only order LED lamps. LED lamps are more expensive than conventional lamps (fluorescent and otherwise). Energy Management is matching funds to ensure energy efficient LED lamps are ordered.

Goals FY 2020-2021:

Funding:

As noted earlier Opt-Out credits have peaked due to operational consolidations and reduced energy usage. NCDPS is aggressively taking advantage of every funding option available by:

- Opting-Out of Renewable Energy Portfolio (REP) duplicate credits which will result in about $20,000 in additional credits. The overall impact of total credits received this year should be neutral.
- Taking advantage of Duke Energy’s SBES Program which offers aggressive rebates up to 70% for turnkey energy efficiency projects (energy audit, cost estimate, purchase and retrofit) for small sites.
- Pursuing sewer credits for water leaks to reimburse the costs of these investigations and repairs.
- Developing a performance contract for Adult Corrections by FEB 2021 for leadership review. It will include completion of exterior lighting retrofits, select sites for interior lighting retrofits, and water management systems. As noted previously, about $11M in yearly funding is needed for energy and water efficiency projects to meet our targets; thus, performance contracting (PC) is the only solution at this time unless a bill is passed similar to HB 1292. PC is an appropriate vehicle for funding projects that emphasize quick paybacks and are narrowly focused in scope and scale.
- Introducing a matching fund program for lighting retrofits with maintenance personnel. Opt-Out funds are being used to split the cost for every light fixture/lamp that is purchased by a local unit. This ensures local units retrofit fixtures/ lamps using high efficiency LEDs rather than conventional fluorescent or high pressure sodium.
- Continuing to rally support for legislation equal or better than HB 1292.

$250k in R&R funds is being requested this fiscal year to support measures that cannot be funded from Opt-Out. If approved, projects are slated for lighting and BMS upfits for our smaller divisions (Juvenile Justice, State Highway Patrol and SBI), and, funds for water leak detection and repairs for our Adult Correction facilities. This presents a continued challenge pitting energy/water efficiency measures against life-safety and security R&R needs.

Analyses:

- The Energy & Water Dashboard will be used to pinpoint and further investigate the top five sites with the best and worst energy intensities since FY 2016-2017 to determine the cause for the decreases/increases. Best practices will be developed from the lessons learned.
- The last of the transportation rate natural gas accounts will be transitioned back to utility purchased gas. Estimated savings will be $100k per year.

Staffing:

- Energy Management: If approved, another ¾ time energy intern (Opt-Out funded) and an assistant energy manager by Fall 2020 will be hired. Central Engineering will assist DOP with onboarding the new AC Energy & Sustainability Manager.
- Maintenance: High performance maintenance can result in energy savings of over 15%. The existing energy management team will strategize with the new AC Energy Manager on how to overcome current personnel shortages and alternative means of addressing this aspect of energy efficiency. An option is to hire centrally

based teams dedicated to Maintenance Based Commissioning (MBC) that focus on water leak detection, and high-performance maintenance.

Projects:

Exterior Lighting: Purchase and install $500k in exterior LED light fixtures this fiscal year. Fixture solutions for the remaining sites (approximately 31) will be completed by July 2021. *If this pace of funding continues, another five years of funding is required to fully convert all our sites to exterior LED light fixtures.* At least three sites will be assisted in having their utility owned exterior lighting converted to LED.

Interior Lighting: Make Foothills CI the first facility with 100% LED lighting for both interior and exterior lighting applications. Fund $145k in interior lighting LED retrofits including SBES projects. Target 15 additional sites for SBES audits. Complete photometric analyses and fixture selections for all interior lighting inmate individual cells and dormitory rooms.

Building Management Systems (BMS): Upgrade the network backbone of the BMS systems at our NORESCO sites (Harnett CI, NCCIW and Nash CI). Begin upfitting Nash CI's BMS in accordance with the new NCDPS BMS design guidelines. Fund an additional $40k for the installation of variable frequency drives. Complete Phase II of the BMS Design Guidelines by focusing on specification performance standards, the layout of the point property pages, summary diagnostic tables, data analytics, and name tagging.

Thermostats: Investigate and deploy where feasible Duke Powe's free programmable thermostat for small businesses throughout the Duke Energy territories.

Water Leaks: Complete major water leak repairs at NCCIW by November 2020 and investigate one other site. Attempt repairs if leaks found. Investigate the use of foot pedals in our kitchens to reduce water usage in these areas.

Programs: Initiate a boiler tune-up and training program.

Challenges

Funding: The Energy Team has the talent and drive to attain these targets but does not have the funds and staff to do so. Compared to other institutions of similar scale, an additional seven staff members are needed. 15%+ ROIs can occur while *reducing deferred maintenance, prolonging equipment life, improving maintainability, and, correctional officer and staff safety.*

Maintenance: Maintenance staffing is down by 18 % and over 88 positions because qualified candidates cannot be hired quickly and paid sufficiently. 15%+ energy savings are possible when maintenance teams are properly staffed and high-performance maintenance occurs. A possible and highly viable solution is for the new AC Energy Manager to create a team dedicated to energy management and Maintenance Based Commissioning (MBC). This would also result in *reduced deferred maintenance, prolonged equipment life, improved maintainability, and, correctional officer and staff safety.*

COVID-19: *The COVID-19 pandemic possibly resulted in a reduction in energy and water usage for all divisions except Adult Corrections. Adult Corrections experienced increases that are possibly due to our clients and their proximity to each other. A deeper dive into each division and each site is required to determine the short- and long-term impact of this pandemic, and how we can still effectively address energy and water efficiency opportunities while doing so.*

Opportunities:

Duke Power Programs: Duke has several programs that may benefit NCDPS in the future. One is a Shared Savings Program which is similar to performance contracting in that there are no up-front costs - just payments from the savings. Duke Power is also upgrading to continuous logging meters which can be viewed via a program they called One View. These opportunities require further evaluation.

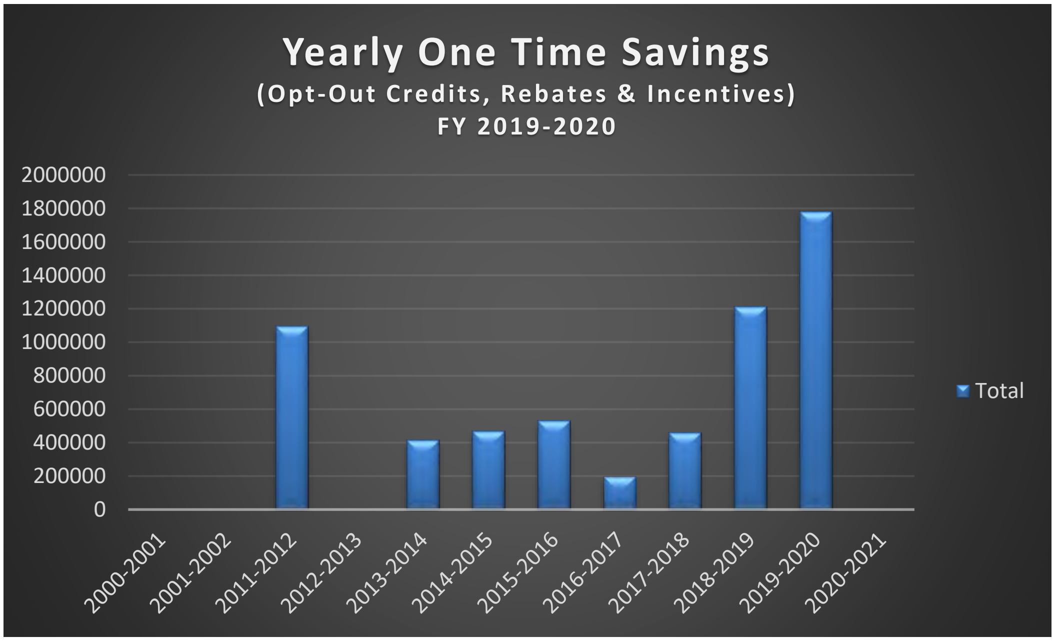
Sustainability: Sustainability can be defined as a means of preserving and enhancing the environment and human quality of life while remaining economically viable. For this reason, sustainability compliments the roles of energy and water managers. The NCDPS program already focuses on human quality of life, security, and economic viability through ROI and reducing maintenance requirements and other opportunities abound. A good start is recycling with a focus on cardboard. Other opportunities are provided in **Appendix C.**

Resiliency, Potential Site Consolidations & Energy/Water Efficiency Impacts: Resiliency can be defined as the ability of NCDPS, its divisions, facilities and staff to proactively face and address more frequent and intense storms, flooding, drought, and, increasing day and night-time temperatures. This includes logistical issues related to relocation of inmates, goods, and services. Many factors impact energy & water efficiency as well as resiliency that should be taken into consideration if further site consolidations are considered. Questions that should be asked include:

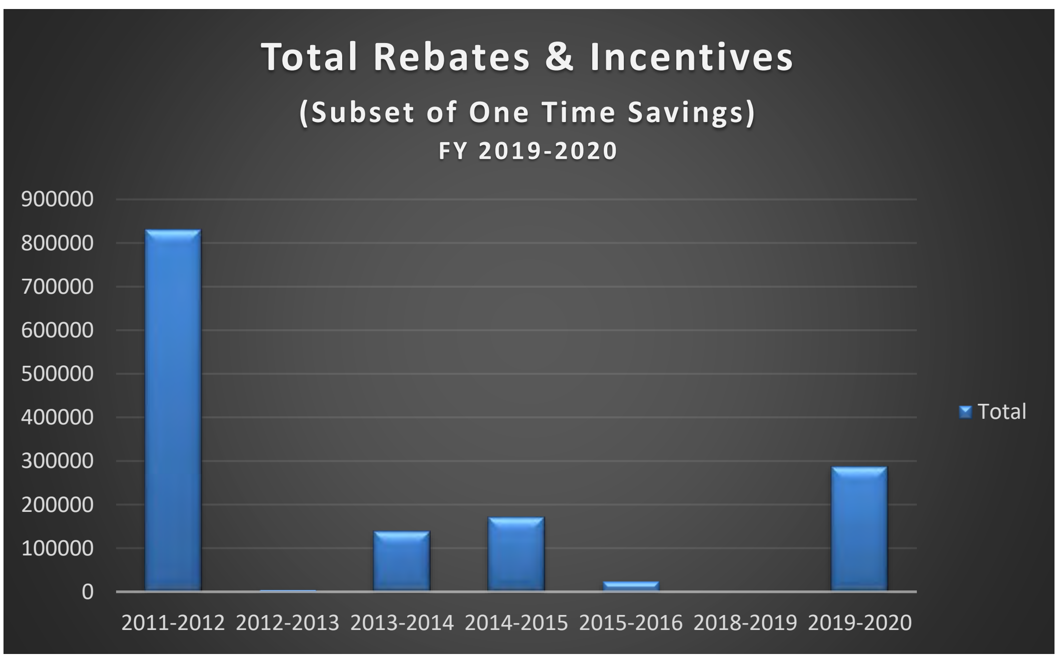
- What sites have the most unairconditioned bed count? (and will require future cooling and energy use)
- What sites have the highest water/sewer, and, electrical costs per unit? (Electric Coops generally have higher rates. Water/sewer rates are generally higher when we are the primary or only industrial/commercial water customer of a water service provider)
- What sites have the oldest facilities and need the most R&R work? (Possible indicator of higher water and energy costs, more poorly insulated buildings, etc.)
- What sites have the most failing roofs? (Can result in poorer indoor air quality due to potential mold issues and reduced energy efficiency due to wet insulation)
- What sites have the oldest, failing infrastructure (electrical and water distribution systems)? (Possible indicator of higher water and sewer costs due to leakage, and cost to upgrade electrical systems)
- What sites have the highest Energy Use Index (EUI - energy use per square foot) and/or Water Use Index (WUI - water use per square foot)? (Relocating to other sites could improve our overall EUI/WUIs and bring us closer to our 40% reduction targets)
- What sites are least conducive to ease of temporary inmate/staff/goods/services relocation? (Higher energy transportation costs and pollution)
- What sites are most prone to excessive and frequency of flooding conditions?

-End-

Relevant Charts

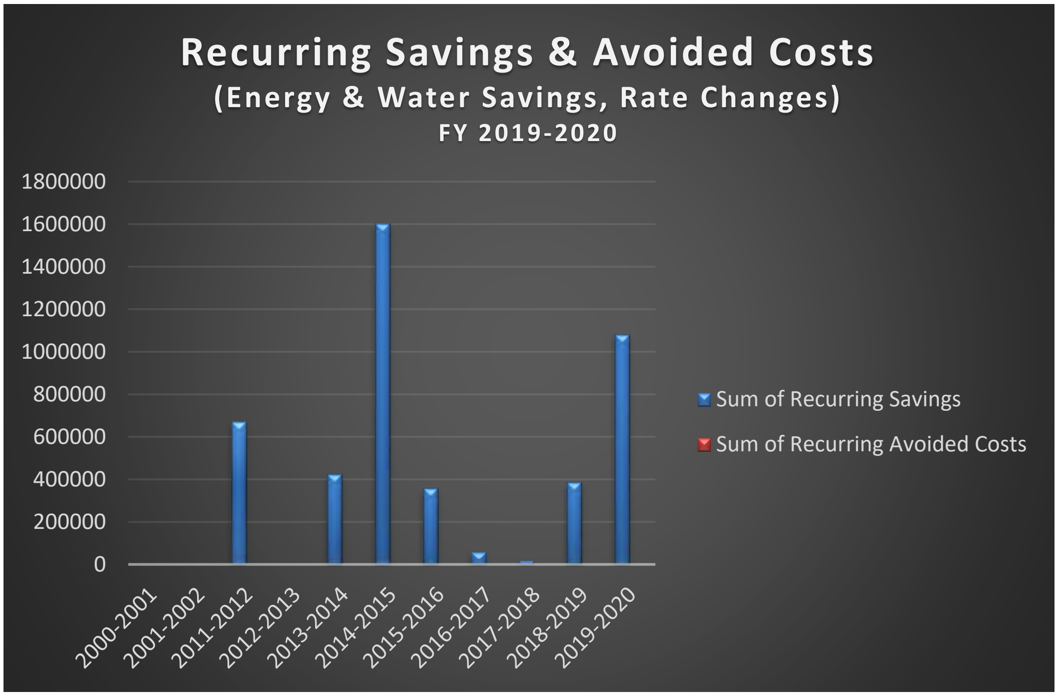


Note increase in Opt-Out credits as the program matured, and rebates/incentives received from Small Business Energy Savers incentives this past fiscal year.

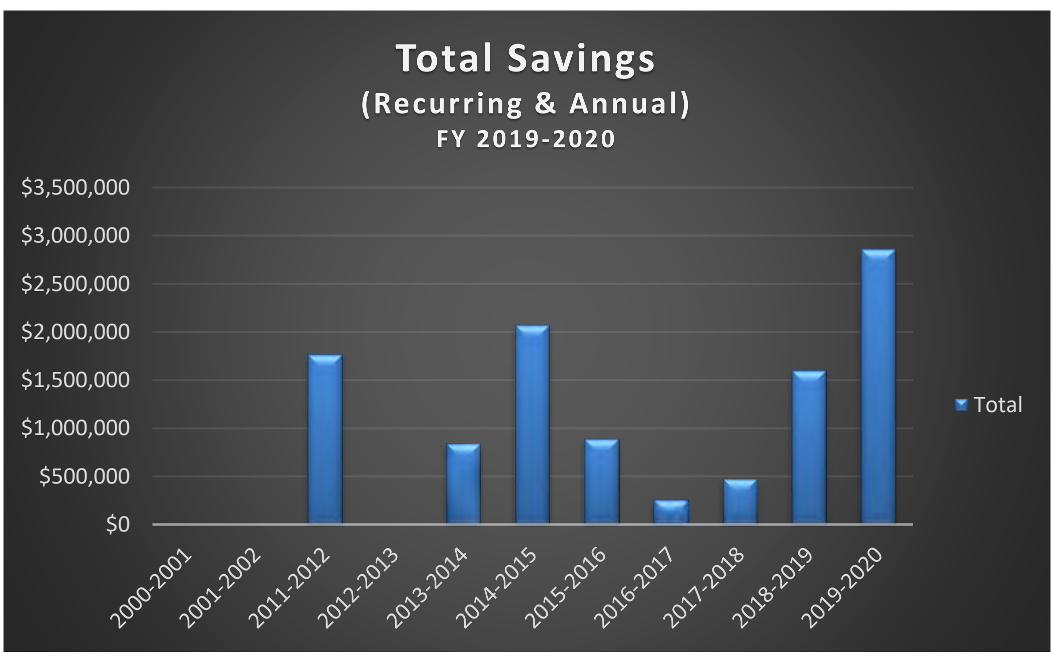


Rebates/Incentives are a sub-set of Yearly One Time Savings. Small Business Energy Savers Program are primarily responsible for FY 2019-2020 increase, though a $32k rebate was received for LED lighting retrofits at Alexander CI.

Relevant Charts

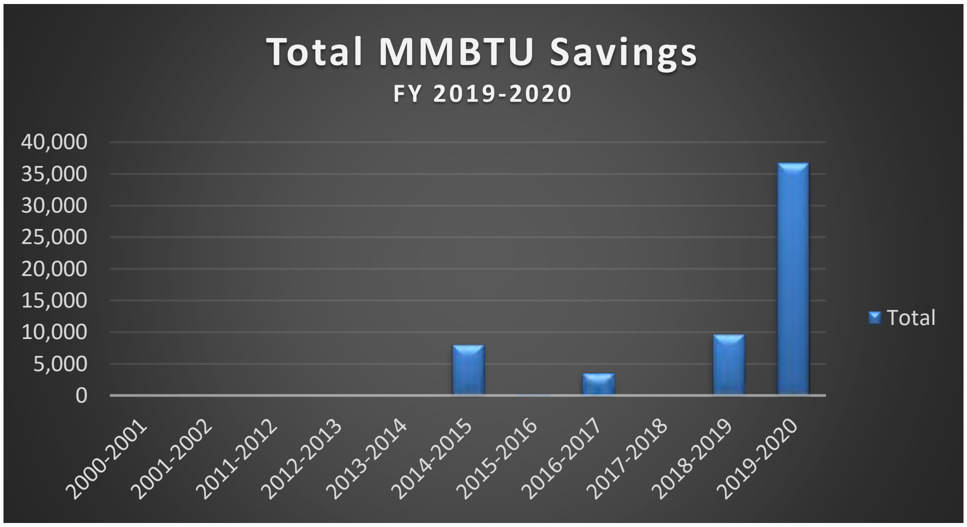


Note increase in recurring savings due to energy/water efficiency. Peaks in 2011-2012 and 2014-2015 reflect the America Recovery & reinvestment Act (ARRA) funded projects and NORESCO projects respectively.



Note increase in yearly savings over the past three years.

Relevant Charts



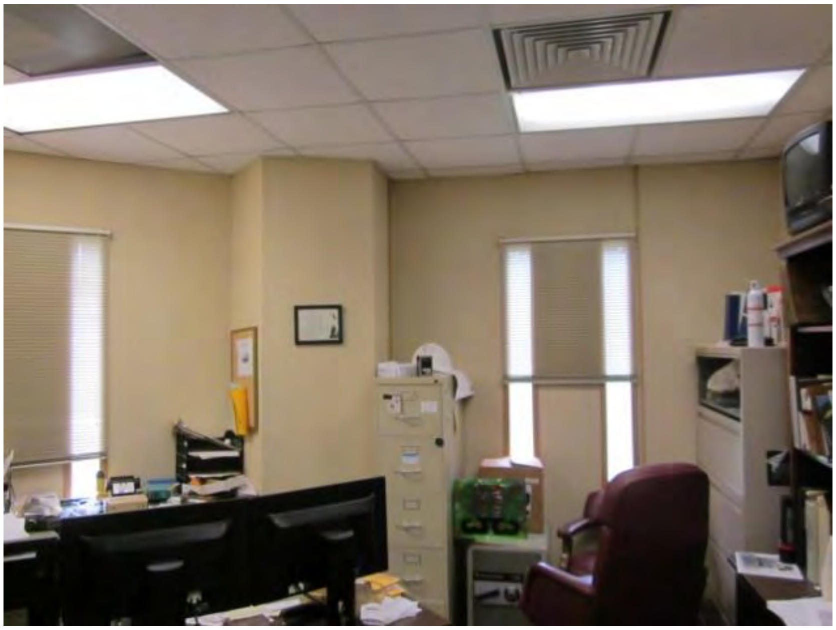
Note increase in energy savings. Savings not available for most projects prior to FY 2017-2018.

Interior Lighting Retrofit Example:

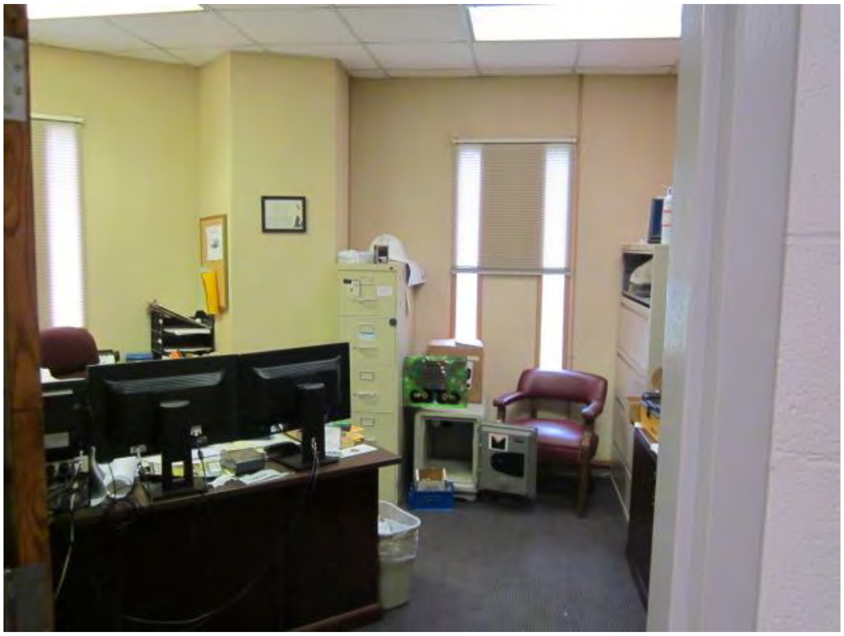
Southern CI (Special Thanks to Jere Spaun and team for his efforts)

Initial light level:	**46 fc**
Final Light Level	**53.5 fc**
Energy Reduction:	**64%**

Before LED Retrofit



After LED Retrofit



Project improved visual acuity and dramatically reduced the exterior lighting maintenance

Thousand Cell Exterior Lighting Retrofits

Before… **After…**

85% Reduction in Energy Use

Project improved visual acuity, enhanced site safety, and dramatically reduced the exterior lighting maintenance

Special thanks for all the site and regional maintenance team members responsible for installing these light fixtures

Thousand Cell Exterior Lighting Retrofits

Before…

After…

After…

Thousand Cell Exterior LED Lighting

82% Power Reduction

Project improved visual acuity, enhanced site safety, and dramatically reduced the exterior lighting maintenance

Appendix A

Historic Efforts to Attain Energy & Water Reduction Targets

FY	Category	Success
2017-2018	Funding	Opt-Out program started resulting in credits of over $300k
	Staffing	4 Summer Interns hired to expedite projects and analyses.
	Exterior Lighting	$250k in exterior LED lighting purchased.
	Interior Lighting	$18 k in interior LED lighting installed. Additional $12 k in LED lighting purchased.
	Building Management Systems (BMS)	Design Guidelines for building management systems started.
	Water Efficiency	DOP Bus Terminal toilets replaced, meter size reduced: ~$7k yrly savings.
	Analysis	~$100k savings by converting two natural gas accounts back to more cost effective rates. Water & electric meters removed and LED lights installed at Umstead CC ~$23k/yr. ~$6k yearly billing error corrected (Capturis billing),

2018-2019	Funding	Opt-Out program credits surpasses $890 k. ~45k rebate for Nash CI Demand Response Agreement.
	Staffing	4 Summer Interns hired to expedite projects and analyses. Several retained throughout fiscal year.
	Exterior Lighting	~$180k yrly cost savings, Exterior Lighting LED Retrofit replacement program begun.
	Interior Lighting	
	Building Management Systems (BMS)	
	Water Efficiency	
	Analysis	~101k Natural Gas tax fee recovery (Teresa Murphy). Phase I of Utility Analytics Dashboard begun. ~315k yrly savings Natural Gas rate changes.

2019-2020	Funding	Our Opt-Out program resulted in credits of over $1.2 M in FY 19-20
	Staffing	Temporary staffing increased by 2 FTE[7]. One student intern hired for the summer. Central Engineering supplemented our project management staff by approximately .25 FTE
	Exterior Lighting	~212k yearly energy savings and over $1M in exterior lights purchased.
	Interior Lighting	~$184k in yearly energy savings and ~$278k in interior lighting projects including Small Business Energy Savings Program (5 sites) and Led lamp retrofits.
	Building Management Systems (BMS)	BMS Design Guidelines I complete.
	Water Efficiency	~$590k savings from Nash CI water leak.
	Analyses	~85k yearly savings electric rate changes, Phase I Energy & Water Data Analytics dashboard completed.

Appendix B:

Projects Anticipated To Be Funded (Through Opt-Out Credits) and Unfunded Projects Needed to Attain Our Target Reductions.

Project Summary: Funded and Unfunded				
Project Summary	**Project Costs:**	**Recurring Savings:**	**Kgal Reduction**	**Sum of Total Energy MMBTU**
2020-2021				
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
LED Exterior Lighting Retrofit	$597,070	$127,426		5,996
Stormwater Fee Elimination	$1	$29,880		0
2021-2022				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Rockingham Duke energy analyses and savings	$239,042			1,416
Rockingham Duke rebate				0
2022-2023				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
2023-2024				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
2024-2025				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Interior LED Lighting Retrofits	$9,061,169	$5,923,363		264,083
Water Management System = to ICON	$17,065,142	$2,059,024	173,200	0
2025-2026				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Water Management System = to ICON	$31,008,198	$3,741,347	314,713	0
Additional HVAC Projects to Attain Goal: Energy	$19,605,668	$4,155,986		185,800
Grand Total	**$81,432,290**	**$17,368,554**	**487,913**	**522,476**

These projects are anticipated to be funded through Opt-Out Funds

These are unfunded projects needed to attain our 40% reductions.

Appendix C: Sustainability Opportunities

Category	Description	Priority	ROI
Land	Native Plantings/Grass		Low
Land	Reforestation		Low
Land	Drought resistant grass		Medium
Land	Xeriscaping, Native plantings, perenials		Medium
Land	Reduce Impervious Areas		Low
Land	Stormwater retention		Low
Farm	No till operations		High
Farm	Reduced chemical Usage		High
Farm	Rainwater capture		Medium
Water Efficiency	BOD Reductions		Medium
Water Efficiency	Water Management Systems		High
Water Efficiency	Low flow aerators		High
Water Efficiency	Low flow flushmeters		High
Water Efficiency	Low flow toilets		High
Water Efficiency	Pressure reducing stations		Medium
Water Efficiency	Leak Detection (including metering) & repair		High
Water Efficiency	(Rain) water reuse		Medium
Energy/Atmosphere	LED Interior Lighting		High
Energy/Atmosphere	LED Exterior Lighting		High
Energy/Atmosphere	Photovoltaics -Leased		Medium
Energy/Atmosphere	Photovoltaics - Owned		Low
Energy/Atmosphere	ZEV/low emission vehicles		Medium
Energy/Atmosphere	ZEV/low emission equipment (lawn care, etc.)		Medium
Materials & Resources:	Local Materials		Low
Materials & Resources:	Lamp Recycling: Bulb crusher		High
Materials & Resources:	Cardboard recycling		High
Materials & Resources:	White paper recycling		Low
Materials & Resources:	Large toilet rolls & dispensers		Medium
Materials & Resources:	Foam Soap Dispensers		Medium
Materials & Resources:	Filter manometers		High
IAQ	IAQ Management & filtration systems		High
IAQ:	Daylight & Views		Low
IAQ:	Green Cleaning - microfiber products		Medium

IAQ:	Green Cleaning - Foam soap, non-antibacterial		Medium
IAQ:	Green Cleaning - products		Medium
IAQ:	Humidity Control		High
IAQ:	Pollution Source Control & Management		Low
IAQ:	Mold reduction		Low
IAQ:	Lead reduction		Low
IAQ:	Asbestos reduction		Low

--End--

NC Department of Revenue

Agency Utility Management Plan

Fiscal Years 2020-2025

Prepared by Business Services and Support
February 2021

NCDOR | NORTH CAROLINA DEPARTMENT OF REVENUE

Executive Summary

The Department of Revenue (DOR) administers the tax laws and collects taxes due in an impartial, consistent, secure and efficient manner to fund public services benefitting the people of North Carolina. As a cabinet agency, the Department is fully committed to supporting Executive Order 80 and working with other agencies to meet the established goals:

- Reduce statewide greenhouse gas emissions to 40% below 2005 levels
- Increase the number of registered, zero-emission vehicles to at least 80,000
- Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels

This document outlines the agency's Utility Management Plan in support these goals.

Background

The main DOR facility is state-owned and maintained by the Department of Administration (DOA). The DOR also has 13 remote offices across the state which are leased facilities. Actions identified in the utility management plan address initiatives associated with the main building as well as the remote offices. Operationally, the agency will evaluate impacts of climate change on programs with the intention of integrating climate change mitigation and adaption practices into our operations. Participating as a member of the North Carolina Climate Change Interagency Council will provide an opportunity to collaborate and share ideas across agencies to enhance DOR programs and initiatives associated with the executive order.

NCDOR NORTH CAROLINA DEPARTMENT OF REVENUE

Utility Management Plan
2020 - 2025

Focus Area 1: Comprehensive Plan	
Strategy 1.	Provide energy saving project recommendations in the DOR Repair and Renovations Request to DOA
Strategy 2.	Update internal plans to reflect energy efficiency strategy and support for Executive Order 80
Strategy 3.	Work with the State Energy Office (SEO) to assist with review of strategy and timeline
Strategy 4.	Continue to provide internal education and update existing marketing plan to support the strategy
Strategy 5.	Implement Plan

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Meet with SEO to develop content for the plan	Discuss the Utility Management Plan content and focus areas	Agency Designee, Energy Manager and SEO staff	As needed
Evaluate operations to identify potential energy savings initiatives	Create list of planned and potential future initiatives to be included in the Utility Management Plan	Agency Designee, Energy Manager and Agency Staff	Annually
Update Utility Management Plan	Complete the plan and timeline for the agency and submit plan to SEO	Agency Designee, Energy Manager and staff	Due March 1, 2021
Participate in Energy Manager meetings with other State Agency's to share ideas	Attend monthly meetings and provide updates on Utility Management Plan progress	Energy Manager	Monthly
Meet with stakeholders and internal teams to implement initiatives included in the plan	Designate a team or teams to implement portions on the plan	Agency Designee, Energy Manager and staff	Quarterly
Update existing marketing and communication program	Continue to improve and implement program	Agency Designee, Energy Manager and staff	Annually
Review Utility Management Plan progress	Review plan; revise and adjust initiatives and timelines as needed	Agency Designee, Energy Manager and staff	Quarterly
Update R&R Requests to recommend energy saving projects to support Executive Order 80	Work with DOA to help prioritize recommended energy saving projects.	Energy Manager and DOA	Annually

NCDOR NORTH CAROLINA DEPARTMENT OF REVENUE

Focus Area 2: Initiatives to Implement	
Strategy 1.	Review opportunities with staff to determine high priority initiatives
Strategy 2.	Work with staff to determine the best timeframe to implement initiatives
Strategy 3.	Create a schedule for planned initiatives
Strategy 4.	Communicate initiatives to staff
Strategy 5.	Implement initiatives

2020-2025 Planned Activities	**Expected Measurement**	**Assigned To**	**Occurrence**
HVAC improvements	Support DOA in installing new fans in primary air handling units	Energy Manager and DOA	FY 2022
Evaluate aging equipment in various areas and develop a master plan for replacement	Replacement of aging equipment based on funding availability (CRAC Units replaced in Scan Room and UPS replacement)	Energy Manager, DOA and staff	FY22 – CRAC Units FY25 – UPS Replacement
Downsize Headquarters Data Center footprint	Continue consolidating server equipment to save energy in our Data Center	Energy Manager and staff	Ongoing through FY23
Modify lighting timers at HQ facility	Work with DOA to have lighting timers adjusted by floor to cut down on light usage	Energy Manager and DOA	May 2021
Promote teleworking; review and revise agency telework policy	Updated telework policy; Continued replacement of desktops with laptops	Agency Designee and staff	Annually
Continue to evaluate potential use of ZEVs	Review use of long term lease and motor fleet vehicles; Review and update internal policies	Agency Designee and staff	Annually
Promote electronic filing	Increase in electronic filing, reduction in time scanners operate	Agency Designee and staff	Annually

NCDOR NORTH CAROLINA DEPARTMENT OF REVENUE

Focus Area 3: Marketing and Communication Plan	
Strategy 1.	Identify marketing and communication initiatives
Strategy 2.	Work with team to identify delivery methods
Strategy 3.	Create a schedule for marketing and communications
Strategy 4.	Develop and Implement initiatives

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Maintain internal employee education campaign	Employee awareness of Executive Order 80 and opportunities to support energy efficiency	Agency staff	Annually
Update marketing plan for electronic filing	Identification of action items to support increased electronic filing	Agency staff	Annually

Focus Area 4: Remote Office Energy Savings (Leased Facilities)	
Strategy 1.	Identify opportunities to downsize leased space
Strategy 2.	Work to identify jobs eligible for permanent teleworking
Strategy 3.	Develop and Implement Initiatives

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Downsize the footprint of Charlotte Office	Move from occupying 24,000 square feet to less than 10,000 square feet.	Agency Designee and staff	FY22
Close Service Center in Winston Salem	Transition employees from the Winston Salem office to other offices, or move employees to permanent teleworking.	Agency Designee and staff	FY21
Analyze space needs for remaining remote offices to identify opportunities to reduce footprint	Reduction in square footage for remote offices as leases expire	Agency Designee and staff	Annually

NCDOR NORTH CAROLINA DEPARTMENT OF REVENUE

Agency Accomplishments since March, 1 2019

- In 2019, the Department of Revenue supported the Department of Administration (DOA) in making HVAC upgrades to the main DOR building. The project included replacement of the outdated controls tied to the HVAC system. This project supports the Executive order by making the HVAC system more energy efficient as well as make it easier to regulate temperature throughout the facility.
- The Department of Revenue funded and upgraded lighting in several locations throughout the main facility. These changes included moving from high energy use lighting to LED lighting in the rotunda areas on each floor and the secretary's conference room. The agency continues working with DOA to move towards replacing lights in other areas of our main building with LED lighting.
- The Department of Revenue funded and upgraded several outdated Power Distribution Units (PDU) throughout the main facility. With the assistance of DOA, the agency has a better utilized power distribution system, one less PDU, and a better source of redundant power to critical equipment.
- The Department of Revenue funded the replacement of outdated computer room air conditioning (CRAC) units located inside the main data center. With the assistance of DOA, one CRAC unit inside the Data Center was downsized resulting in better utilization and efficiency of air flow. The new CRAC units work together with a digital network connection that can turn off or slow down the speed in which the CRAC units cool (not always running at 100% cooling). The older units did not have the ability to regulate the temperature in the same way. The new equipment is helping save energy while still accommodating temperature requirements inside the data center.

Newly installed equipment inside of our Data Center

- The most significant impact this thus far has been the agency's increase in teleworking. A new policy was created and implemented. In March 2020, an estimated 5% of the agency was part-time or full time teleworking. As a result of Covid-19, the agency quickly took action to move employees to teleworking while maintaining agency

NCDOR | NORTH CAROLINA DEPARTMENT OF REVENUE

operations and service levels. To date, approximately 90% of employees are teleworking. Due to the number of employees able to telework, overall power usage in the main facility has been reduced.

- The Department of Revenue has been able to transfer the majority of long term rental vehicles to hybrid vehicles and continues focusing on switching out the remaining vehicles.
- The Department of Revenue created an internal employee education program about Executive Order 80 to include posters throughout all facilities as well as Intranet postings. The Digital Communication Division maintains an Electronic Filing Marketing Plan with the objective of increasing electronic filing for individual and business taxes. For tax year 2019, electronic filing increased by 3% for Individual Income Tax, 6% for Corporate Tax, and 9% for Partnership Tax. Increased electronic filing results in lower power consumption by the high speed scanning equipment.

NC Department of Revenue
Agency Utility Management Plan

- The NC Department of Revenue recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and water management is impacted by all employees and the responsibility of the Energy Manager for Department of Revenue with support from the Department of Administration.
- The Department of Revenue has developed an Agency Utility Management Plan. The Assistant Secretary of Business Services and Support is responsible for the success of the program for Department of Revenue.
- The Agency Utility Management Plan outlines the activities identified to support reduction in energy and water consumption goals with support from the Department of Administration.
- The Department will review progress and results and will support staff attendance at training in energy and water management**.**

Agency Utility Management Plan Goals

- As required in Executive Order 80, NC Department of Revenue will support efforts to reduce energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels and reduce state-wide greenhouse gas emissions to 40% below 2005 levels.

NCDOR NORTH CAROLINA DEPARTMENT OF REVENUE

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Revenue. The plan, as presented, supports the reduction goals in Executive Order 80.

Implemented this 28th day of February 2019
Updated this 24th day of February 2021

Matt King
Agency Energy Manager

3/ 1 /2021
Date

Angela W. Altice
Assistant Secretary, Business Services and Support

3/1/2021
Date

Ronald G. Penny
Secretary, Department of Revenue

3/4/2021
Date

NC Department of Transportation

Agency Utility Management Plan

Fiscal Years 2019-2021

2020 Agency Utility Management Plan

North Carolina Department of Transportation

Table of Contents

Executive Summary

This NCDOT Agency Utility Management Plan (AUMP) has been developed in accordance with N.C. Gen. Stat. 143-64/12(a), and has been updated to support the achievement of goals outlined in Sections 1 and 8 of Executive Order 80 - NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY. The intent of this plan is to support environmental stewardship and reduce the impact of utility usage in NCDOT-owned buildings upon the climate through the responsible use of utilities. This Plan reports FY 2019-2020 utility usage and trends, and summarizes NCDOT strategy and programs supporting legislative and Executive Order 80 goals for fiscal years 2019 - 2021.

This report is updated biennially, and outlines ongoing energy savings programs that will reduce NCDOT energy consumption per square foot in DOT buildings by 40% from fiscal year 2003-2004 levels; support specified goals to preserve and enhance the State's natural resources, and reduce the economic impact of operating a vast transportation network. It will also help the Department to compete for additional funding available through the DEQ / State Energy Office and the Federal Government to fund energy saving programs. Energy and cost saving results to-date from current programs are summarized in the Energy and Usage Data section beginning on page 7.

Since 2003, NCDOT has implemented and tracked energy savings programs that reduce the financial burden and environmental impact of utility usage. At the conclusion of Fiscal Year 2020, DOT and NC State Port Authority (NCSPA) energy savings programs have resulted in an **energy cost avoidance of $28,338,381** and **a water cost avoidance of $13,413,637 totaling $41,752,018** over the last 16 years. By the end of FY 20, those cost savings have **reduced energy and water costs per square foot by 31% and 8% in DOT facilities respectively** as measured from the baseline fiscal year of 2003-2004. NCSPA saw a **22%** increase in energy usage, but a reduction in water consumption by **3%** per square foot during that same period. **Combined DOT and NCSPA energy and water consumption per square foot has decreased by 26% and 7% respectively since fiscal 2003-04**.

Due to the type of buildings used by NCSPA, the success of efforts to reduce energy costs in buildings is not evident by measuring energy use per square foot. A more informative metric of energy usage in NCSPA buildings is energy cost per ton of cargo transported through port terminals. In FY 20 there was a **31% increase in energy usage of per ton of cargo and a 4% increase in water usage by per ton** compared to usage during the baseline fiscal year of 2003-04.

At the conclusion of fiscal year 20, NCDOT (DOT and NCSPA) employees occupied at total of 2,382 buildings, totaling 9,376,748 square feet, with building utility costs totaling $10,771,348.

FY 20 - 22 strategies, programs, roles and deadlines are summarized in Appendix A on page 13, and energy and cost reductions achieved through FY 20 are illustrated in the following tables and graphs.

Table 1 – Total Energy Usage for DOT and NCSPA during FY 20

Agency	Building Square Fee	Total Building Utility Expense
DOT	6,552,374	$9,184,593
NCSPA	2,824,363	$1,586,755

Figure 1 – Total Avoided Utility Cost for DOT and NCSPA combined

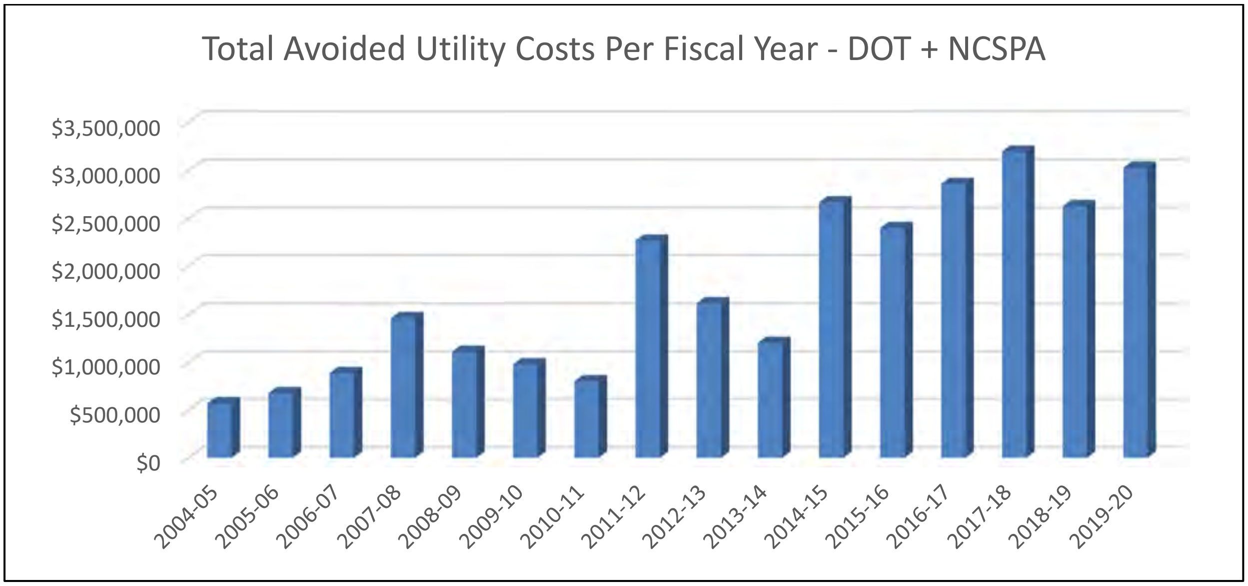


Figure 2 – % Change in Energy Usage for DOT

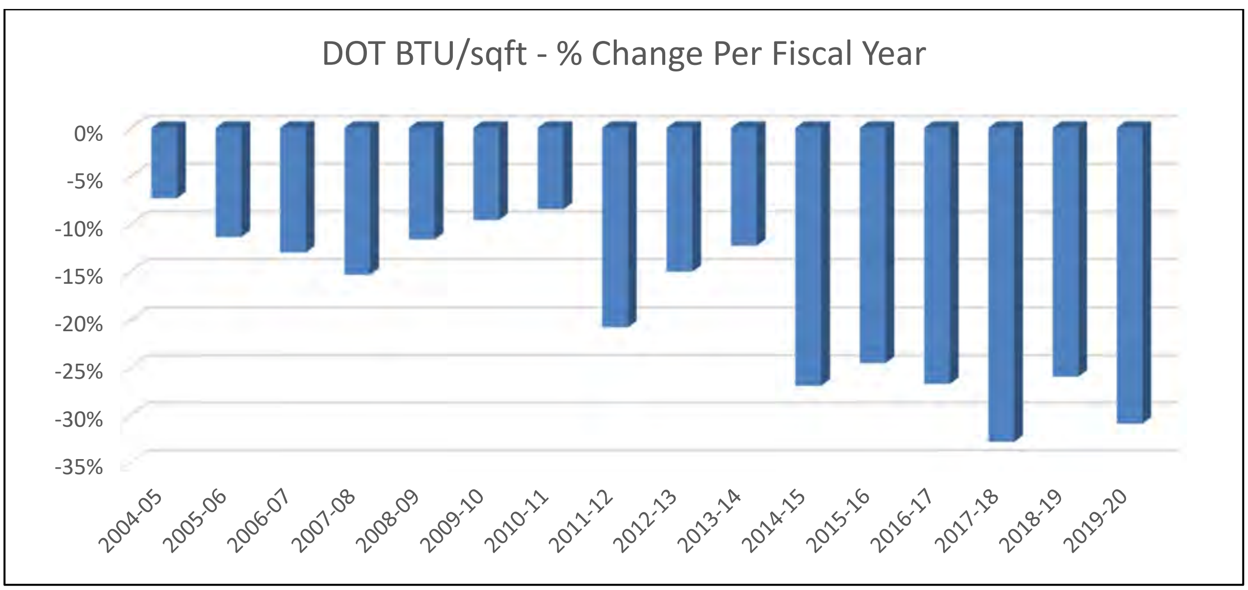


Figure 3 – % Change in Energy Usage for NCSPA

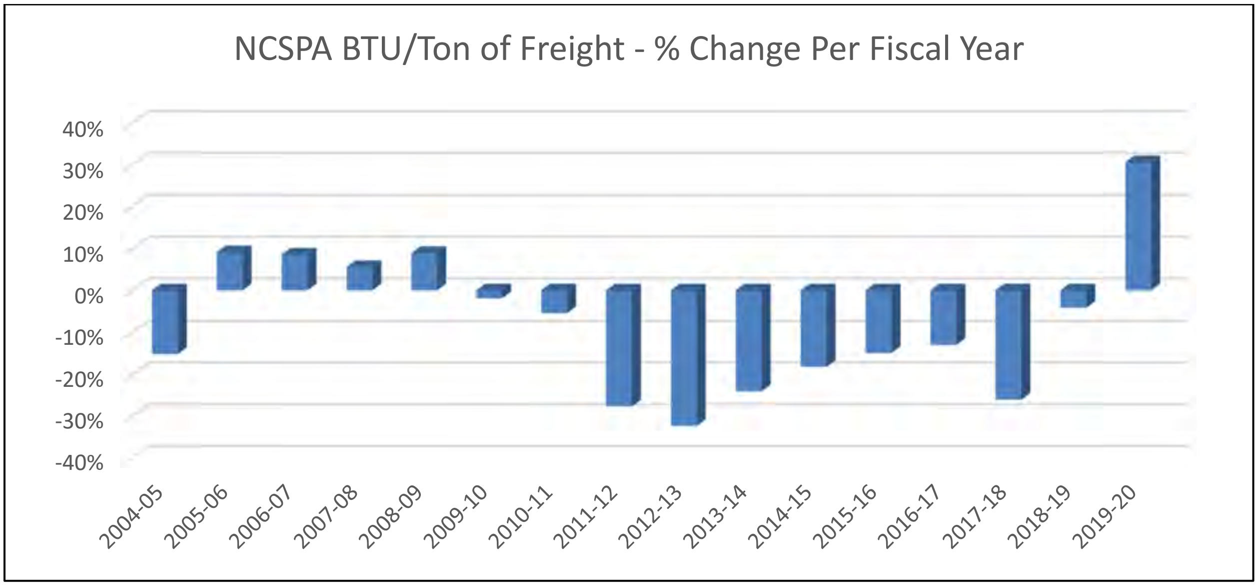
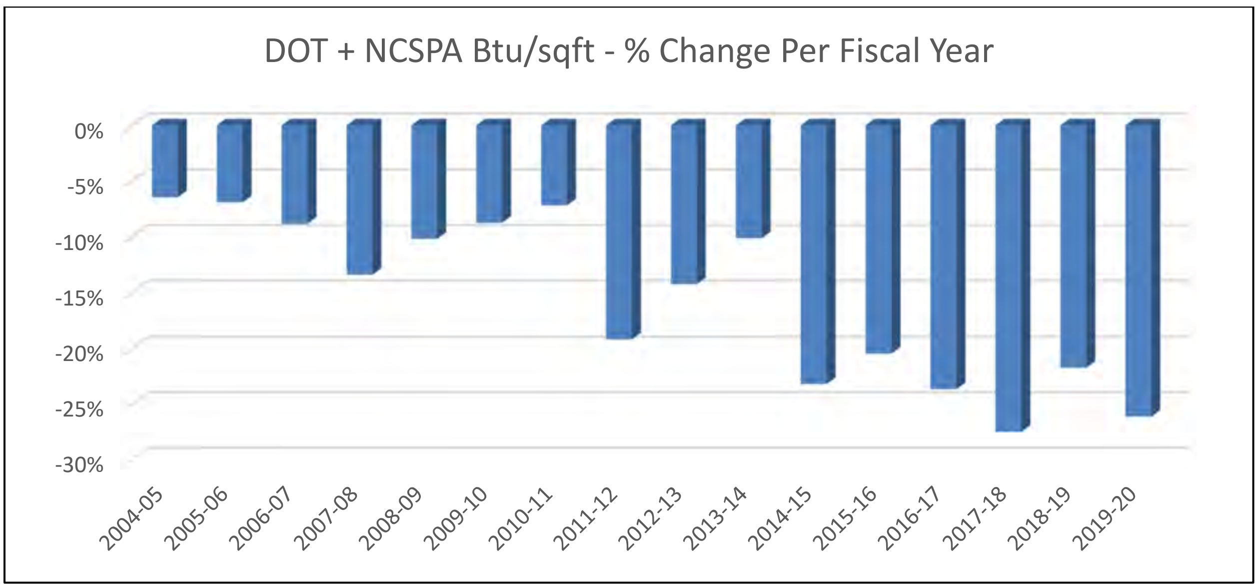


Figure 4 – % Change in Energy Usage for DOT + NCSPA



The following is a summary of the legislative and executive basis for this report, NCDOT energy reduction programs with additional data and tables illustrating results to-date.

Basis for NCDOT Agency Utility Management Plan

The Agency Utility Management Plan (AUMP) for NCDOT was developed in accordance with General Statute 143-64.10-12, *Energy Conservation in Public Facilities*, which mandates a comprehensive energy management program for State government, and Section 8 of Executive Order 80 (EO-80), NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY. This AUMP also meets the objectives of the State Utility Savings Initiative as managed by DEQ.

NCDOT Energy Conservation Programs

The primary NCDOT programs to achieve Executive Order 80 and legislative energy conservation goals are:

- <u>Guaranteed Energy Savings Contract (GESC)</u>
    - Use GESC as approved for state buildings or utility systems under General Statute 143-64.17, as a vehicle to fund and implement energy-related improvements.
    - *Building GESC*
        - Installed Energy Conservation Measures (ECMs) in 6 buildings in Raleigh
        - Installed more energy efficient HVAC system, lighting, windows and water fixtures.
        - Installed a building automation system to improve energy savings and monitor energy usage.
            - This system can be expanded to monitor and control HVAC systems in other DOT facilities.
        - Guaranteed cost savings over 15 years: **$8,897,860**
        - Status: Ongoing – in energy savings period
    - *Roadway Lighting GESC*
        - Upgrading roadway light fixtures on state-owned roads and in NCDOT buildings state-wide to LED-based fixtures.
        - Upgraded **10,689 roadway light fixtures** to LED-based fixtures.
        - Upgraded **14,981 interior and exterior light fixtures** in **805 DOT buildings** to LED-based fixtures.
        - Installed lighting control system to monitoring energy usage and support maintenance of fixtures.
        - Cost of installation and maintenance over 15 years to be paid from energy and operational savings.
        - Guaranteed cost savings over 15 years: **$51,295,813**
        - As of 11/11/2018 this is the only roadway lighting project in the US where project savings are used to:
            - Upgrade all state-owned roadway lighting
            - Install a lighting control system

        - Maintain & repair installed roadway lighting systems
    - Status: Ongoing -in energy savings period.

- Energy Efficiency Incentives
    - Partnering with utility providers to utilize energy efficiency incentive programs to reduce the cost of NCDOT projects - both vertical and horizontal.
    - Utilities provide a rebate for the installation of approved energy efficient hardware as well as funding approved measures / projects that will save energy.
    - Projected energy incentives from utility companies to reduce the cost of the *Roadway Lighting GESC* project by over **$1,500,000**.
    - Incentives totaling **$338,000** were received by NCDOT for the *Building GESC* project.
    - Status: Ongoing

- Analysis of Utility Accounts and Billing
    - Measuring and analyzing utility bills to identify opportunities to reduce cost and provide data in support of new and ongoing projects.
    - Investigating the use of Capturis and other utility data tracking systems as well using modified energy usage and costs reports using data from AP database.
    - As of 02/15/2020, NCDOT pays the cost of ~ 15,025 (electricity, water, gas, fuel oil, etc.) accounts.
    - Verify billing using appropriate rates.
    - Consolidate accounts to take advantage of lower rates.
    - Identifying excessive energy usage to identify and take corrective action.
    - Status: Ongoing.

- Building Energy Efficiency Design Standards
    - Ensure compliance with 2012 NC State Energy Code: Energy Conservation Code / NCGS 143-135.35, Article 8C so that new and renovated building designs are energy efficient.
    - Implement additional energy efficiency / sustainability design standards and other best practices for new and renovated buildings.
    - Status: Ongoing.

- Energy Audits
    - Perform energy audits of facilities to identify opportunities for energy and water conservation, and perform cost/benefit analysis for the proposed measures.
    - Plan and implement appropriate energy conservation projects funding permitting.
    - Status: Ongoing.

- NC Workspace Standards
    - Implementing latest State Property Office workspace standards in new and renovated buildings.
    - Reduces space / buildings needed in new and renovated buildings, energy consumption, and costs.
    - Status: Ongoing

- Training
  - Train facility managers / staff to perform preventative maintenance of existing and new systems to ensure energy and water conservation objectives are met and maintained.
  - Ensure adequate training is included in the scope of work for building projects.
  - Status: Ongoing

- Partner with Other Agencies on Energy Savings Programs
  - Work with the Department of Environment Quality (DEQ) / State Energy Office (SEO), and other agencies to participate in existing or planned energy savings programs - particularly those funded / sponsored by those agencies.
  - Energy audits paid with funding from other agencies.
    - Usually coordinated by DEQ / SEO
  - Status: Ongoing

- Education
  - Educate / inform / engage NCDOT employees regarding state-wide energy conservation project and best practices through meeting presentations, emails, Intranet web sites, etc.
  - Status: Ongoing

Energy and Utility Usage Data

The following tables and graphs list and illustrate utility usage and costs in NCDOT owned facilities from the baseline year of FY 2003-04 to-date as well as progress toward achieving energy conservation and other goals specified in EO-80 and legislation.

Figure 5 – DOT Utility Costs for FY 2019-20

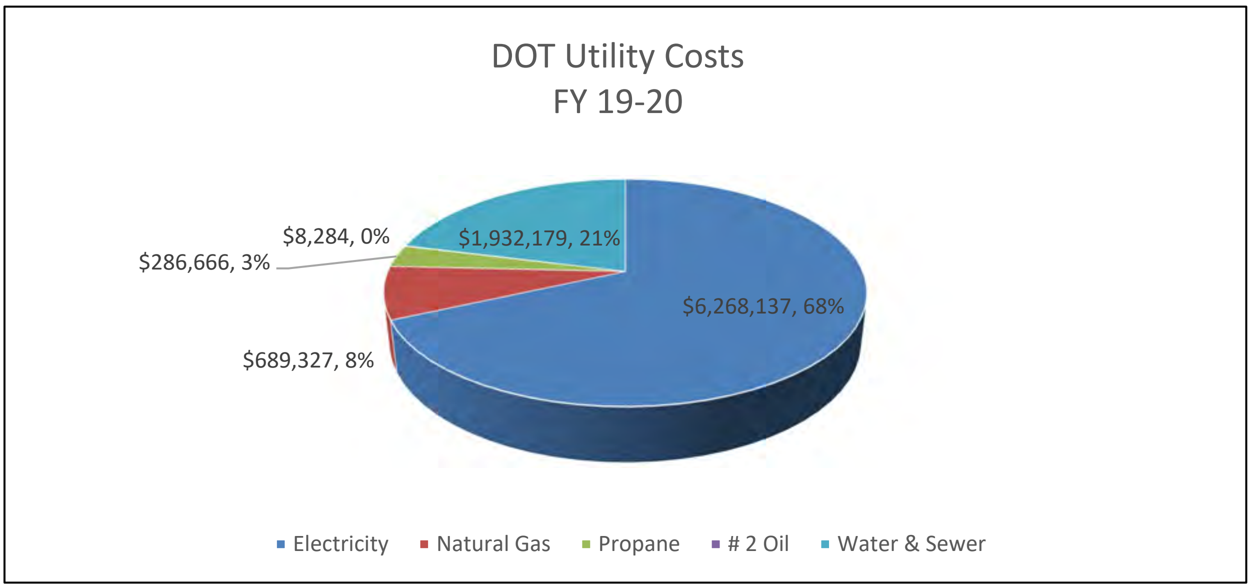


Figure 6 – DOT Total Utility Costs Per Year

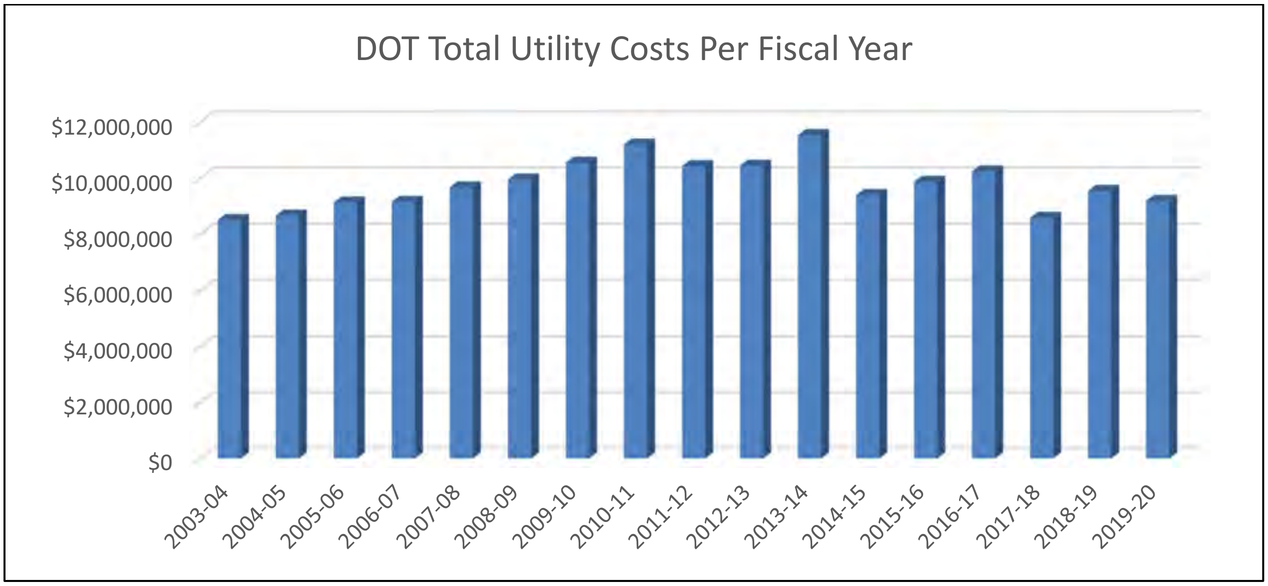


Figure 7 – NCSPA Utility Costs for FY 2019-20

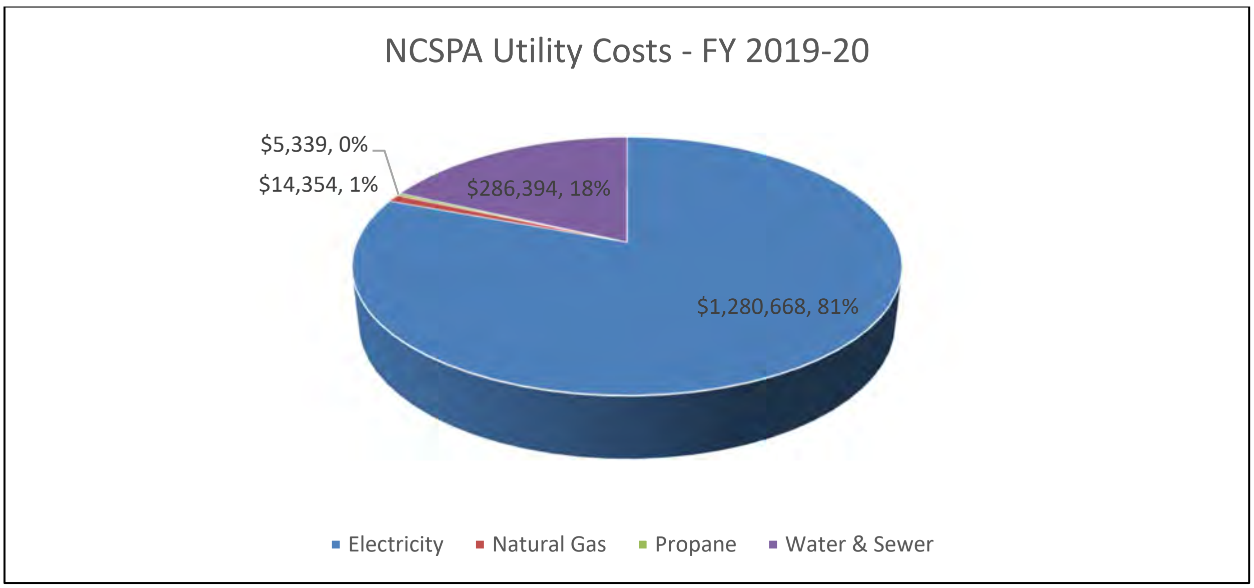


Figure 8 – NCSPA Total Utility Costs Per Fiscal Year

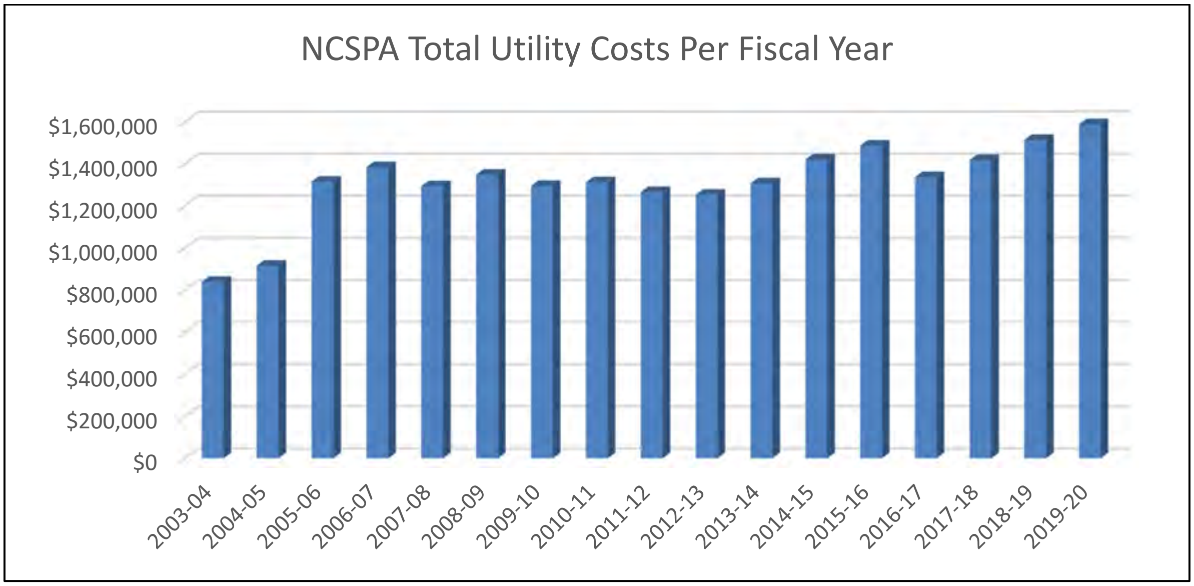


Figure 9 – DOT + NCSPA Utility Costs for FY 2019-20

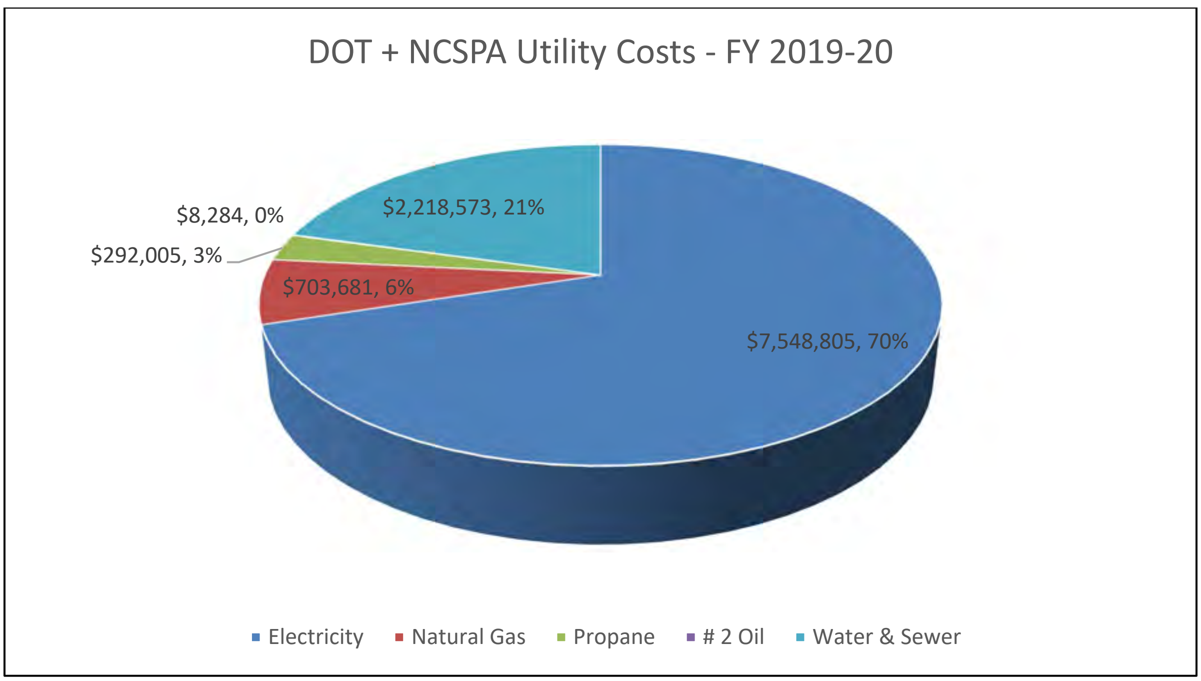


Figure 10 – DOT + NCSPA Utility Costs Per Year

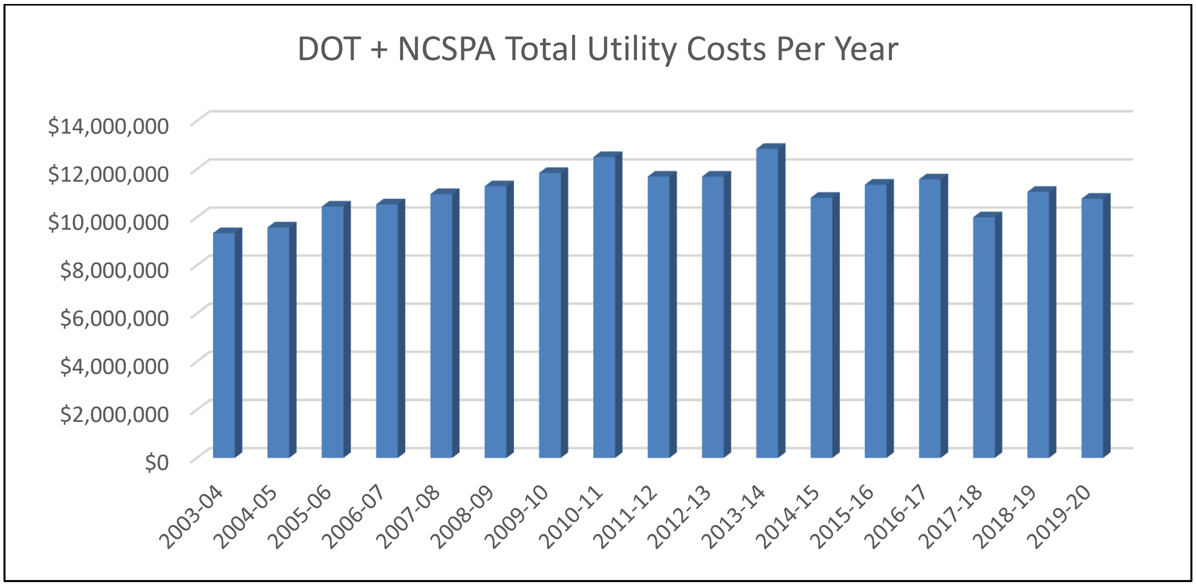


Table 2 – DOT + NCSPA Total Utility Costs and Savings Per Year

Fiscal Year	Total Utility Cost	Total Energy Cost	Total BTU	Total Savings / Cost Avoidance
2003-04	$9,341,426	$7,968,465	468,194,525,603	$0
2004-05	$9,575,686	$8,252,231	440,432,559,838	$681,870
2005-06	$10,445,101	$9,102,939	442,095,953,042	$948,020
2006-07	$10,534,967	$9,151,251	435,071,335,280	$1,289,426
2007-08	$10,962,336	$9,426,863	421,516,401,078	$1,975,965
2008-09	$11,293,419	$9,773,003	441,776,595,730	$1,567,344
2009-10	$11,841,312	$10,197,596	451,010,172,592	$1,939,150
2010-11	$12,505,316	$10,349,287	463,559,419,547	$2,572,585
2011-12	$11,693,641	$9,543,376	406,075,671,419	$4,065,367
2012-13	$11,693,575	$9,725,755	422,504,327,079	$2,139,048
2013-14	$12,842,594	$10,663,448	454,034,725,899	$1,258,751
2014-15	$10,811,735	$8,815,598	388,128,689,644	$4,470,425
2015-16	$11,354,444	$9,316,551	405,665,608,567	$3,567,365
2016-17	$11,576,783	$9,213,902	394,589,016,967	$3,227,339
2017-18	$10,000,673	$8,415,292	378,824,523,811	$4,888,300
2018-19	$11,056,122	$9,447,950	385,933,161,556	$3,027,378
2019-20	$10,771,348	$8,552,775	369,093,657,350	$3,188,775

Table 3 – DOT + NCSPA Utility Energy Usage Per Year

Fiscal Year	Elect - kWh	NG - therms	#2 oil - gals	Propane - gals	Water - kgal
2003-04	86,652,990	1,111,591	10,081	533,782	261,994
2004-05	85,256,357	885,493	12,200	561,665	242,988
2005-06	89,688,007	835,562	4,802	491,151	221,089
2006-07	89,396,867	772,125	3,275	475,535	206,793
2007-08	85,876,819	821,193	37,180	449,864	204,064
2008-09	86,587,839	907,786	58,725	517,370	211,582
2009-10	85,337,729	993,424	59,069	570,699	174,478
2010-11	89,730,765	999,185	70,528	520,451	153,404
2011-12	89,022,044	684,572	25,353	331,259	153,048
2012-13	82,430,157	970,481	25,358	443,958	218,086
2013-14	87,254,878	1,082,185	42,896	459,951	275,758
2014-15	75,191,176	842,193	31,990	468,320	148,538
2015-16	79,198,293	774,510	29,863	587,559	181,319
2016-17	76,128,423	764,352	26,747	596,787	250,203
2017-18	68,714,683	1,040,101	30,436	394,323	141,420
2018-19	75,545,860	933,992	12,389	360,656	150,182
2019-20	73,012,385	924,707	2910	295,710	260,682

Table 4 – Roadway Lighting Energy Savings Performance Contract Project - Costs and Energy Savings

Schedule N

Guaranteed Cash Flow Analysis

Total Financed Costs:	$ 33,454,594		Escalation Rate by Utility/Fuel*	
Finance Term Years:	15		Electric:	0%
Annual Interest Rate:	2.75%		Natural Gas:	0%
Construction Months:	16		Steam:	
First Year Payment:	$ 2,793,285		Water:	0%
Principal	$ 34,596,945	including construction period interest	Other (specify):	
Interest	$ 7,725,119		Escalation Rate for Annual Fees (Avg):	2.38%

Yr.	Guaranteed Electric Dollar Savings	Guaranteed Electrical Dollar Savings from Control System	Other Guaranteed purchased Fuel Dollar Savings	Guaranteed Water Dollar Savings	-	Guaranteed Operational Dollar Savings	Total Guaranteed Dollar Savings (a)	Annual Service Fees (b)	Financing Cost (P&I) (c)	Net Savings (= a-b-c)
0	$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
1	$ 1,202,563	$ 156,718	$ -	$ -	$ -	$ 1,824,648	$ 3,183,929	$ 390,644	$ 2,793,285	$ -
2	$ 1,202,563	$ 142,297	$ -	$ -	$ -	$ 1,864,243	$ 3,209,104	$ 455,354	$ 2,753,750	$ -
3	$ 1,202,563	$ 130,047	$ -	$ -	$ -	$ 1,899,065	$ 3,231,675	$ 465,740	$ 2,765,935	$ -
4	$ 1,202,563	$ 118,913	$ -	$ -	$ -	$ 1,934,595	$ 3,256,071	$ 476,465	$ 2,779,606	$ -
5	$ 1,202,563	$ 108,492	$ -	$ -	$ -	$ 1,970,846	$ 3,281,902	$ 487,541	$ 2,794,361	$ -
6	$ 1,202,563	$ 98,576	$ -	$ -	$ -	$ 2,009,372	$ 3,310,511	$ 514,365	$ 2,796,146	$ -
7	$ 1,202,563	$ 89,043	$ -	$ -	$ -	$ 2,046,039	$ 3,337,645	$ 526,489	$ 2,811,156	$ -
8	$ 1,202,563	$ 79,815	$ -	$ -	$ -	$ 2,084,555	$ 3,366,933	$ 539,009	$ 2,827,923	$ -
9	$ 1,202,563	$ 70,837	$ -	$ -	$ -	$ 2,122,225	$ 3,395,624	$ 535,614	$ 2,860,010	$ -
10	$ 1,202,563	$ 62,068	$ -	$ -	$ -	$ 2,162,292	$ 3,426,923	$ 548,642	$ 2,878,281	$ -
11	$ 1,202,563	$ 53,481	$ -	$ -	$ -	$ 2,210,637	$ 3,466,680	$ 636,702	$ 2,829,978	$ -
12	$ 1,202,563	$ 45,051	$ -	$ -	$ -	$ 2,250,095	$ 3,497,709	$ 652,104	$ 2,845,605	$ -
13	$ 1,202,563	$ 36,760	$ -	$ -	$ -	$ 2,292,095	$ 3,531,418	$ 685,670	$ 2,845,748	$ -
14	$ 1,202,563	$ 28,596	$ -	$ -	$ -	$ 2,333,153	$ 3,564,312	$ 702,431	$ 2,861,881	$ -
15	$ 1,202,563	$ 20,545	$ -	$ -	$ -	$ 2,375,019	$ 3,598,127	$ 719,728	$ 2,878,399	$ -
Total	**$ 18,038,442**	**$ 1,241,240**	**$ -**	**$ -**	**$ -**	**$ 31,378,878**	**$ 50,658,561**	**$ 8,336,497**	**$ 42,322,064**	**$ -**

NOTES:
1) Annual Net Savings must never be negative.
2) A surplus in one year cannot be carried forward to create positive cash flow in a subsequent year.
3) "Annual Service Fees (b)" includes Owner 3rd party review fee of + ESCO M&V + Service fees
4) Guaranteed savings values will be verified per calculation methods in Schedule F.
5) Interest rate as provided by ISSUER to ESCO. Payments are calculated monthly in arrears.
6) Electric and Operating savings will all be combinned and guaranteed annually as a total savings amount and not individually.
7) Construction Period Interest is capitalized for calculation of Financing Costs (P&I)

Table 5 – Building Energy Savings Performance Contract – Costs and Energy Savings

Yr.	Guaranteed Electric Dollar Savings	Guaranteed Natural Gas Dollar Savings	Guaranteed DOA Steam and Chilled Water Dollar Savings	Guaranteed Water Dollar Savings	Other Please Specify	Guaranteed Operational Dollar Savings	Guaranteed Dollar Savings (a)	Annual Service Fees (b)	**Financing Cost (P&L) (c)	**Net Savings = a-b-c
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$162,321	$ 598,169	$ 27,760	$ 570,408	$ 1
2	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$161,670	$ 597,518	$ 28,315	$ 569,200	$ 3
3	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$161,005	$ 596,854	$ 28,882	$ 567,972	$ 0
4	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$160,328	$ 596,176	$ 29,459	$ 566,716	$ 1
5	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$159,637	$ 595,485	$ 30,048	$ 565,436	$ 1
6	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$158,932	$ 594,780	$ 30,649	$ 564,128	$ 3
7	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$158,213	$ 594,061	$ 31,262	$ 562,796	$ 3
8	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$157,479	$ 593,328	$ 31,888	$ 561,440	$ 0
9	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$156,731	$ 592,580	$ 32,525	$ 560,052	$ 2
10	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$155,968	$ 591,817	$ 33,176	$ 558,640	$ 1
11	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$155,190	$ 591,038	$ 33,839	$ 557,196	$ 3
12	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$154,396	$ 590,244	$ 34,516	$ 555,728	$ 0
13	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$153,586	$ 589,435	$ 35,206	$ 554,228	$ 0
14	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$152,760	$ 588,609	$ 35,911	$ 552,696	$ 2
15	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$151,918	$ 587,766	$ 36,629	$ 524,581	$ 26,556
Total	$ 4,634,691	$ (729,240)	$ 2,632,275	$ -	$ -	$ 2,360,134	$ 8,897,860	$ 480,065	$ 8,391,217	$ 26,578

Appendix A

NCDOT Agency Utility Management Plan

2019-21

Focus Area 1: Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect energy efficiency strategy toward 40% reduction in Btu/gsf and EO-80 goals.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2019-2021 Planned Activities	**Expected Measurement**	**Assigned To**	**Occurrence**
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Quarterly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager, Agency Staff, and NCDOT Climate Change Workgroup	Due March 1, 2019, thereafter October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	As available
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager, Agency staff, and NCDOT Climate Change Workgroup	May, 2019

2019-2021 Planned Activities	Expected Measurement	Assigned To	Occurrence
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager, Agency Staff, and NCDOT Climate Change Workgroup	May, 2019
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager, and NCDOT Climate Change Workgroup	Quarterly
Track and analyze utility data	Record monthly utility data for annual utility report to submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year
Performance Contracts	Verifying guaranteed energy savings are achieved, and execute contractual requirements	Energy Manager and Agency Staff	Monthly monitoring and annual energy savings verification.
Energy Efficiency Incentives	Partner with utility providers to utilize energy efficiency incentive programs to reduce the cost of NCDOT projects - both vertical and horizontal.	Energy Manager and Agency Staff	Evaluate by project.
Building Energy Efficiency Design and Workspace Standards	Implement most recent NC State Energy Code and additional energy efficiency / sustainability design standards, SPO workspace standards, and other best practices for new and renovated buildings.	Energy Manager and Agency Staff	Update quarterly.
Partner with DEQ / State Energy Office and other agencies on energy savings projects	Coordinated with DEQ and other agencies.	Energy Manager and Agency Staff	As available
Training	To promote preventative maintenance of new and existing systems to maintain expected energy savings.	Energy Manager and Agency Staff	As contractually required.
Education	To inform and promote energy savings	Energy Manager and Agency Staff	TBD

2019-2021

Focus Area 2: Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Create a schedule for projects to be implement during the fiscal year
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	Expected Measurement	Assigned To	Occurrence
Building Energy Performance Contract	Annual energy savings	Energy Manager and Agency Staff	Ongoing
Roadway Lighting Energy Performance Contract	Completion of construction work by 3/31, annual energy savings, and compliance with contractual maintenance requirements.	Energy Manager and Agency Staff	Ongoing
Energy Efficiency Incentives	Funds received per project	Energy Manager and Agency Staff	Ongoing
Analyze and track uility accounts to reduce costs and identify problems to correct	Funds saved	Energy Manage and Agency Staff	Ongoing
Investigate options for tracking utility data	Determine the best method to track utility data	Energy Manager and Agency Staff	Ongoing
Energy Audits and Corrective Measures	Identification of buildings that show excessive energy usage; determine cause and implement corrective actions.	Energy Manager, DEQ, and Agency Staff	TBD
Building energy efficiency design and SPO workplace standard	Update annually	Energy Manager and Agency Staff	Annually
Develop priority list of projects for 2020-21	Develop list of projects and start to schedule implementation for next fiscal year	Energy Manager and staff	June 30, 2020

NC Department of Transportation

Agency Utility Management Plan Declaration

- The NC Department of Transportation recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and Water management is the responsibility of the staff at each facility, guided and supported by the NCDOT Energy Management Engineer.
- The Department of Transportation has implemented an Agency Utility Management Plan for NCDOT-owned facilities. The Director of Facilities Management Division is responsible for the success of the program in NCDOT facilities.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption in NCDOT-owned facilities to achieve the goals of the program.
- The Department Secretary's staff will review progress and results, and will support staff attendance at training in energy and water management.

Agency Utility Management Plan Goals

As required in Executive Order 80, NCDOT will support efforts to reduce by 2025 total energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels, and implement energy efficiency best practices and programs in support of these goals.

Agency Utility Management Plan – Measures

Our tracking measures will be the following Key Performance Indicators:

Total Energy Use per Square Foot
Total Energy Cost per Square Foot
Total Water Use per Square Foot
Total Water Cost per Square Foot

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Transportation. The plan, as presented, supports the reduction required in Executive Order 80.

Updated this 1 st day of March 2021.

DocuSigned by:
2CD73228B5AA49B...

Eric R. Frazier
Energy Management Engineer

Director, Facilities Management Division

Department Secretary

STRATEGIC ENERGY MANAGEMENT PLAN

for

NC DEPARTMENT OF AGRICULTURE

&

CONSUMER SERVICES

Prepared By:

Property & Construction Division

1001 Main Service Center

Raleigh, NC 27699-1001

SEPTEMBER 2020

EXECUTIVE SUMMARY
Current Status

The North Carolina Department of Agriculture & Consumer Services (NCDA&CS) has been using an excel spreadsheet to track utility usage since 2002. In 2011, the NC Forest Service and Soil & Water Divisions were transferred from what was at that time the NC Department of Environment and Natural Resources (NCDENR) to NCDA&CS. Energy utilization for these divisions was incorporated into the existing data maintained by NCDA&CS. Because the information from the prior periods was not available for the additional buildings, a new benchmark for data tracking and energy usage was created.

NCDA&CS manages 206 locations across the state with a total of approximately 1200 state-owned buildings with a total gross square footage of 3,840,010. The range in size of the facilities vary from 1 office building to a 400-acre research station with 87 buildings or 33,000-acre state forest with 40 buildings to the NC State Fairgrounds with previously (before COVID 19) 500 events year round. Seventy-two percent (72%) of the buildings are less than 2,500 square feet and used as a field office for 1 – 4 employees or for storage. NCDA & CS has buildings whether State Owned or leased in 99 counties across NC Statewide. The diversity of sites from size, use, number and type of building, present a challenge in monitoring utilities and identifying energy savings initiatives.

Prior to November of 2016, NCDA&CS utilities were submitted directly to Accounts Payable for payment. Invoices were scanned and sent to Divisions for review. Either throughout the year or annually when requested, Divisions would gather energy usage and cost information to be submitted for the Annual Energy Report. This system provided inconsistencies in the reporting because data collection was completed at the site level. In November of 2016, NCDA&CS transitioned to a 3rd party service for utility data collection. The first full year of data collection was 2017-18 and after reviewing the report for 2018-2019, data from the energy evaluation was a significant decrease from the prior years. In 2019-2020 there was also a decrease in energy consumption; however , with COVID19 and less people in the workplace, this is an extremely difficult year to assess.

NCDA&CS will continue to work to develop and implement efforts to improve energy and water conservation at all locations. The initial step being to create, implement and follow an effective Strategic Energy/Water Conservation Plan. The objective of the Strategic Energy/ Water Conservation Plan is to foster economically and environmentally responsible usage of valuable resources in accordance with State legislation.

FOCUS AREAS

Focus #1 – Data Management

2017 – 18 Planned Activities
Overview: In November of 2016, NCDA&CS transitioned to a 3rd party utility billing system. The new system will provide consistency in collection and reporting of key elements from each invoice. Accounting Staff will monitor the system for expenditures, changes in service and late fees.
Responsible Groups: Accounting Clerk
Funding Source: General Operations and Salary
Metric: Notification of late fees, recording of necessary data; fewer disruptions in service

2017-18 Planned Activities
Overview: Using the 3rd party utility billing system identify a revised baseline and benchmark for assessing energy and water usage by Division down to site level.
Responsible Groups: Division staff – positions to be determined
Funding Source: Salaries
Metrics: Benchmarks established for each Division

Future Planned Activities

- Identify baseline data and benchmarks for each location with an emphasis on large energy consumers such as labs, greenhouses and animal facilities

Focus #2 – Facility Management

2016-17 Past Activity
Overview: Upgrading of lighting at NCDA&CS facilities through Duke Energy Incentives. Initiate upgrades at the Farmers Markets & Agriculture Event Centers
Responsible Groups: Property & Construction Division staff & site managers
Funding Source: General Appropriations & Receipts
Metric: Reduction in energy usage tracked through Capturis.

2017-18 Past Activities
Overview: In 2016, NCDA&CS initiated a project to identify all state-owned buildings. The project has been useful in verify building existence, utilization, and square footage. The project is scheduled to be completed no later than June 30, 2018.
Responsible Groups: Property & Construction Division staff
Funding Source: General Appropriations and Salaries
Metric: Accurate & Up-to-date building inventory.

Focus #2 – Facility Management

2017-18 Past Activities
Overview: Assessment of energy and water usage for each NCDA&CS managed site using the reports and graphs from the 3rd party billing system.
Responsible Group: Site Managers
Funding Source: Salaries
Metric: List of energy savings projected by site

Future Planned Activities
- Identify low or no cost initiatives
- Evaluate energy savings from lighting upgrade project at Farmer's Markets and Ag Center, evaluate other sites for lighting upgrades
- Identify unused and underutilized buildings; disconnect utilities and demolish
- Design new buildings to be energy efficient, utilizing green technology if applicable

Focus #3 – Organizational Communication and Outreach

2017-18 Past Activities
Overview: Notify all site managers and administrative staff of the 3rd party utility billing system; provide access information; identify training opportunities
Responsible Groups: Accounts Payable staff
Funding Source: General Appropriations and Salaries
Metric: Site staff accessing the system and running reports to track energy and water usage

Focus for Future Planned Activities 2019-2021
- Identify training modules for all NCDA&CS staff to be assigned through LMS to aid in identification of no cost and low cost savings opportunities.
- Pilot program through State Property Fire Insurance to allow sensors on equipment such as Hot water Heaters, Pipes and condenser Units to notify staff about freezing pipes or differential temperatures.
- Demolition and severance of multiple hazardous Buildings to eliminate current utility bills.
- Roof replacement and repairs on approximately 53 Buildings throughout NCDA & CS sites to minimize excessive energy consumption.
- The Completion of the NCDA & CS new Agricultural Science Center Lab in Raleigh which will house 5 existing Laboratories into 1 shared building complex. Estimated completion time to be end of October 2020. This will be more cost effective and energy efficient because the currently used aged buildings do not have upgraded mechanical/electrical/ components that aren't using todays standards in construction.

Strategic Energy Plan
North Carolina Wildlife Resources Commission
2020-2021

Executive Summary:

North Carolina Wildlife Resources Commission is dedicated to reducing its impact on the environment. The agency's missions include habitat conservation, watershed enhancement, and non-game and endangered species protection. The agency is dedicated to lowering its carbon footprint and thus its total energy and water consumption. The purpose of this Strategic Energy Plan is to make the staff aware the energy is a controllable expense and to reduce the total amount of energy consumed by NCWRC.

Key elements of the plan include:

- Educating and engaging faculty, staff, and students in energy and water conservation through presentations, emails, handouts, and other effective forms of communication that help the understanding that effective energy conservation supports the primary mission of The CC by using less funding for operating expenses which may provide more funds for curriculum purposes.
- Accurate measurement and analysis of electricity, fossil-based fuels, and water usage, including a quarterly review of trends and costs.
- Conducting energy audits to identify opportunities for conservation. Developing cost/benefit estimates for opportunities and appropriately prioritizing projects based on probable benefit and available resources.
- Executing approved physical plant equipment projects, process improvements, and vehicle purchases that reduce the net consumption of fossil based fuels and increase the creation and use of sustainable energy sources.
- Annual review of utility Billing Rates with suppliers.
- Applying sustainable building practices in all major facility construction/renovation projects, and in operating and maintenance of buildings in accordance with US Green Building Council / LEED standards to the highest level practical.

1. North Carolina Legislative basis for the Plan:

a. *Session Law 2007-546 / Senate Bill 668* - Energy Consumption per gross square foot to be reduced by 20% by 2010 and 30% by 2015 based on the 2003-2004 fiscal year. Each State Agency to update its management plan annually and include strategies for supporting consumption reduction requirements. Each State Agency shall submit to the State Energy Office an annual written report of utility consumption and costs.

b. *Session Law 2008-203 / Senate Bill 1946* - Energy Efficiency Improvement: 30% for major construction projects, 20% for major renovation projects based on 2004 codes. Water Use: for major construction or renovation projects 20% less indoor potable water use, and sum of outdoor potable water use and harvested storm water use at least 50% less based on 2006 NC Building Code.

2. Organizational Support for Energy Culture Change

- Attempt to educate people of the public as well as state employees within Wildlife about the energy efficient designs and features within the Wildlife Headquarters building in Raleigh.
- Attempt to educate managerial staff on the benefits of using LED & CFL lamps, programmable thermostats, and occupancy sensors.
- Continue the process of having employees who code utility invoices keeping electronic files of energy consumption and bill amount

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Tours of Green Building for students, public, and state employees	3	2	n/a	n/a	Salary		Jeff Cole	O&M
Educate hatchery and depot managers about the benefits of LEDs, programmable thermostats, and solar panels.	2	2	n/a	n/a	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Tours of Green Building for Students, Public, and State Employees	3		n/a		Salary		Jeff Cole	O&M
Educate hatchery and depot managers about the benefits of LEDs, programmable thermostats and solar panels.	2		n/a		Salary		Jeff Cole	O&M

3. Supply Side

- Review Energy rates with service providers
- Note and investigate changing trends

Past 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Reviewed Energy Rates with other Electric Companies	5	5	n/a	n/a	Salary		Jeff Cole	O&M
Review Rates with water providers	4	4	n/a	n/a	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Review Rates with other Electric Companies	5		n/a		Salary		Jeff Cole	O&M
Review Rates with water providers	4		n/a		Salary		Jeff Cole	O&M

Demand Side

- Take part in surveying depots, hatcheries, and education centers for potential energy savings opportunities.
- Initiate project to refit different wildlife sites with occupancy sensors, compact florescent bulbs, and programmable thermostats.

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Upgrade HVAC software controls package at HQ Building	1	1	15%	TBD	Salary		Jeff Cole	O&M
Replace HVAC units at Pisgah Education Center	1	1	15%	TBD	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Replace Boiler system at HQ Building	2		TBD		Salary		Jeff Cole	O&M

I have read the Strategic Energy and Water Plan for my Organization. The plan, as presented, supports the reductions required in Senate Bill 668.

Implemented this _3rd__ day of _September 2020.

Facilities Mechanical Engineer
Jeff Cole

Engineering Section Chief
Gary Gardner

Appalachian
STATE UNIVERSITY

2022 – 2023 Strategic Energy and Water Management Plan

August 2022

Table of Contents

Note from the Associate Vice Chancellor for Facilities Management

Appalachian State University is excited to share its Strategic Energy and Water Management Plan for the 2022/23 school year. Energy and water efficiency are essential to the success of the university's push towards climate neutrality. We invite students, faculty, staff, and the public to review the plan and reach out to energymanager@appstate.edu with any questions, concerns or requests for additional information.

N. W. Katers

Nick Katers,
Associate Vice Chancellor for Facilities Management

Executive Summary

Appalachian State University has a long-standing commitment to sustainability. Various university commitments and state mandated benchmarks all drive towards one overarching goal, climate neutrality.

For the purpose of this Strategic Energy and Water Management Plan (SEP), climate neutrality is defined in relation to the university's campus energy and water consumption. Appalachian State University's Office of Sustainability has a broader focus that encompasses additional considerations such as the impacts of food consumption, material sourcing, travel, commuting, etc. This SEP is written with the goal of eliminating energy and water-related greenhouse gas emissions by 2050. This target year is set as the latest possible timeline and used as a way of measuring progress. Actual energy and water reductions are intended to be made as aggressively as possible.

Strategic Planning

A data driven analysis of the university's energy and water consumption provides an opportunity to evaluate progress, identify issues, and prioritize solutions that can help the university reach its climate neutrality goals. Establishing specific, measurable, and realistic goals allows for the development an informed strategy. The SEP evaluates three target areas for the fiscal year (FY) from July 2022 through June 2023:

1. Energy and Water Use
2. Energy and Water Expense
3. Greenhouse Gas Emissions

Year in Review

This past year represented a return to pre-pandemic operations. As expected, both water and energy consumption increased. While modest increases in consumption of electricity, gas, and water were anticipated, the most significant and unexpected factor was the cost of energy.

Natural gas prices increased to their highest level in recent years. In May 2021, the university was paying $3.62 per dekatherm. In May 2022, that same amount costed $7.41. These additional expenses impact energy management and climate efforts at App State in two primary ways:

- Rising energy costs reduce the amount of 1292 carry-forward funding available to expand campus efficiency efforts.
- Rising utility costs strengthen the argument for implementing campus efficiency measures

Figure 1 compares last year's campus-wide consumption levels to both FY 20/21 and FY 18/19, the most recent complete school year that was not impacted by COVID-19.

Figure 1. Annual Campus-Wide Consumption Figures

	2021/22 Totals	2020/21 Totals	2018/19 Totals
Facility Greenhouse Gas Emissions	37,803 MT eCO_2	37,942 MT eCO_2	42,036 MT eCO_2
Vehicle Greenhouse Emissions	788 MT eCO_2	666 MT eCO_2	889 MT eCO_2
Energy Use Intensity	79.9 kBTU / sq.ft.	81.9 kBTU / sq.ft.	93.9 kBTU / sq.ft
Water Use Intensity	14.5 gal / sq. ft.	11.4 gal / sq.ft.	17.1 gal / sq.ft.
University Energy Expense	$7.39 million	$5.86 million	$6.8 million
Water and Sewer Expense	$1.3 million	$1 million	$1.2 million

Moving Forward

Figure 2 represents goals for FY 2022/23 to ensure the university is on track to meet target reductions for achieving climate neutrality by 2050. Realistically, progress is not likely to follow an annual linear curve but these targets provide the university with the opportunity to monitor progress and determine how limited resources can most effectively be spent.

Figure 2. FY 22/23 Energy and Water Goals

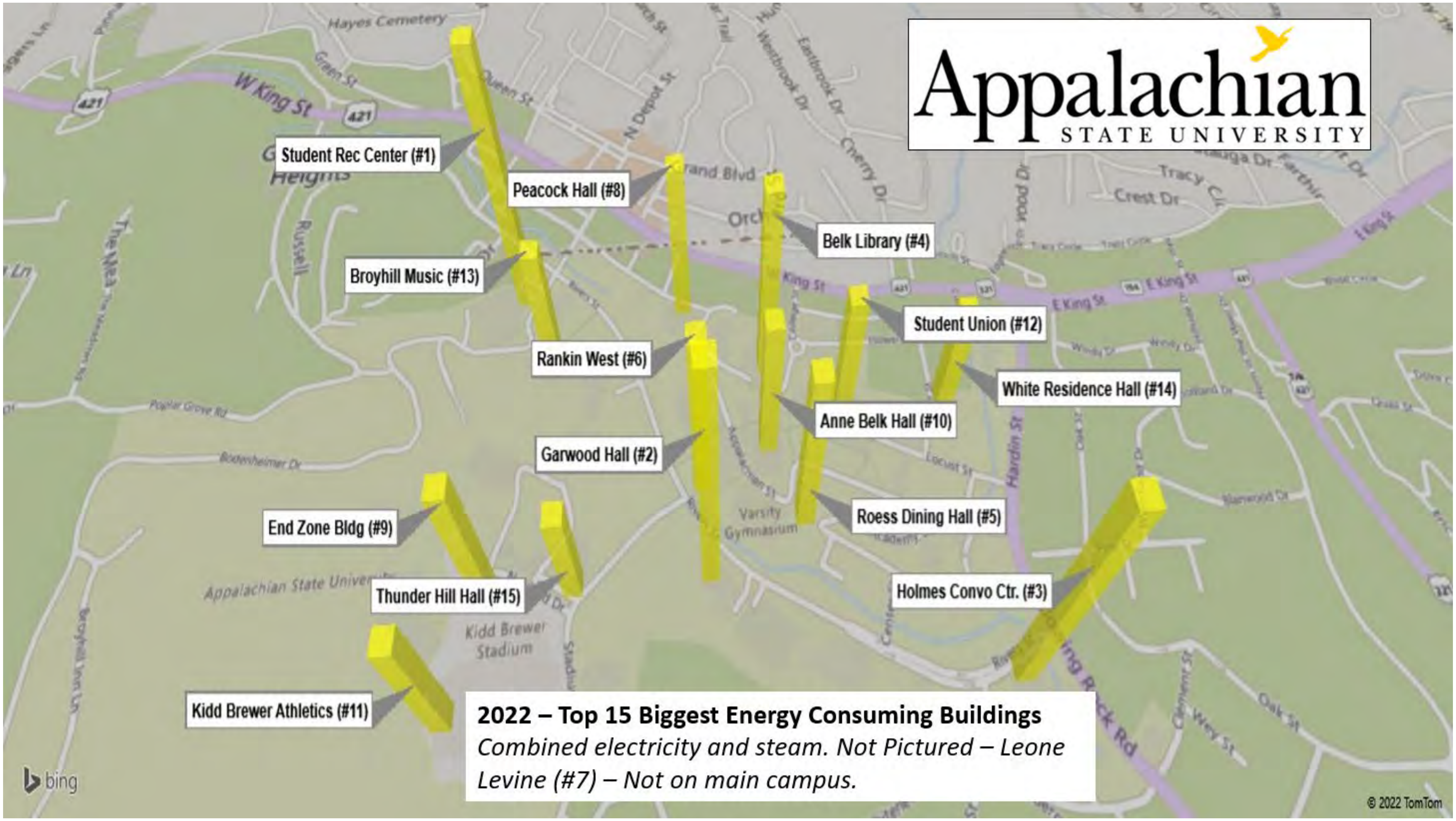
	FY 22/23 Goal
Facility Greenhouse Gas Emissions	11% reduction to 33,752 MT eCO_2
Vehicle Greenhouse Gas Emissions	5% reduction to 749 MT eCO_2
Energy Use Intensity	1.5% reduction to 78,657 BTU per sq.ft
Water Use Intensity	2.5% reduction to 13.8 gallons per sq.ft.
Energy Expenses	Maintain current expenses at $7.38 million
Water & Sewer Expenses	3% reduction to $1.26 million

Strategies for Achieving Energy and Water Goals

Also included in this plan is a list of recently completed energy conservation measures (ECMs) as well as identified potential ECMs that would reduce utility cost and consumption. Prior to completing an ECM, the university considers the cost effectiveness and overall impact it will have on the university.

In order to ensure that limited funds are spent effectively, Facilities Operations must prioritize conservation measures by considering potential savings. Figure 3 highlights the 15 most energy intensive campus buildings. While ongoing efficiency work occurs in every building, this map serves as guide of where some of the most significant potential savings exist.

Figure 3. FY 21/22 – Biggest Energy Consumers



Sustainability Commitments and State Mandates

The following provides a brief background on several university and state-mandated initiatives that guide energy and water consumption goals.

- **Climate Action Plan** – Appalachian State University published the 'AppCAP 1.0" A vision for Climate Neutrality' was published in 2020 and serves as a roadmap to guide the University with actionable and achievable steps to reach climate neutrality.[1]
- **American College & University Presidents' Climate Commitment –** 2008
- **Second Nature Climate Commitment** - Signed by Chancellor Sheri Everts in 2016, this is a commitment from Appalachian State University to reach climate neutrality by 2050.[2]
- **Faculty Senate –** Passed a resolution to achieve climate neutrality by 2035.[3]
- **North Carolina Senate Bill 668** – Passed in 2007, SB 668 promotes the conservation of energy and water use in state, university, and community college buildings. New buildings must be built 30% more energy efficient, renovations must be 20% more energy efficient, and water efficiency in new buildings must be improved by 20%.[4]
- **House Bill 1292** - 2009 – HB 1292 allowed institutions of the University of North Carolina to carryforward unspent annual utility funds that could be documented as a result of installed energy conservation measures. Once awarded, those funds can be spent during the following fiscal year, 60% of which must go towards additional efficiency measures.[5]
- **The UNC Policy Manual** – In 2013, the UNC System stated that UNC institutions must develop plans to become carbon neutral as soon as possible and 2050 at the latest. [6]
- **Executive Order No. 80 –** In 2018 Governor Cooper established North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy. The plan called to reduce statewide greenhouse gas emissions to 40% below 2005 levels, increase the number of state-owned and leased zero emission vehicles to 80,000, and reduce the energy consumption per square foot in state owned buildings by 40%.[7]

For the purpose of this SEP, the goal of climate neutrality by 2050 is used as a target for reducing energy and water usage and emission levels. A specific year is selected so that annual reduction goals can be assigned. However, the 2050 timeline should not be a limiting factor as reductions in energy and water use will be pursued as aggressively as possible.

[1] https://sustain.appstate.edu/initiatives/climate-action/
[2] https://secondnature.org/signatory-handbook/the-commitments/#climate-commitment
[3] https://today.appstate.edu/2019/12/20/climate-neutrality
[4] https://www.ncleg.gov/Sessions/2007/Bills/Senate/PDF/S668v0.pdf
[5] https://www.ncleg.gov/Sessions/2009/Bills/House/PDF/H1292v0.pdf
[6] https://sustain.appstate.edu/_documents/UNC-System-Sustainability-Policy.pdf
[7] https://www.ncdhhs.gov/about/department-initiatives/climate-change-and-clean-energy-plans-and-progress

Greenhouse Gas Emissions

In order to achieve climate neutrality, net greenhouse gas (GHG) emissions[8] will need to be effectively reduced to zero metric tons of equivalent carbon dioxide (MT eCO_2). In order to eliminate university GHG emissions, a realistic understanding of current emission levels is required. Included in this document are the emissions from electricity and fossil fuels consumed by university facilities and vehicles. Other GHG emissions related to broader university activities are tracked by the Office of Sustainability.

GHG emissions in this SEP are broken down into two categories: facilities and vehicles. Facilities include all campus buildings and other infrastructure that consume energy (leased facilities, parking decks, athletic fields, etc.) Vehicle emissions track university-owned and leased vehicles from academic departments, App State Police, Food Services, Facilities Operations, Athletics, Traffic, etc. Not included are the AppalCART busses and New River Light and Power who both provide services beyond the university.

Renewably Sourced Electricity

Appalachian State University has seen sustained reductions in GHG emissions, however, significant work remains to ensure these downward trends continue. Beginning January 2022, university-owned, New River Light and Power (NRLP) began purchasing electricity from a new provider, Carolina Power Partners (CPP). While CPP provides electricity that is 100% produced by natural gas, the company allows customers to enter contracts with third parties to supply renewably sourced electricity, an option not previously available from Blue Ridge Energy. App State and the Renewable Energy Initiative committed to purchasing 15% of its electricity from zero-carbon hydropower facilities under NRLP's new Green Power program.

The university also began purchasing solar generated electricity for remaining university buildings outside of NRLP's service area. Blue Ridge Energy's new Brighter Future program represents new generation from the co-op's 11 MW photovoltaic array located in Caldwell County, NC. Figure 4 details specific amounts of renewably generated electricity that the university began purchasing in January 2022. Currently these agreements are all one-year funded commitments.

Figure 4. Breakdown of University Commitments to Renewably Generated Electricity

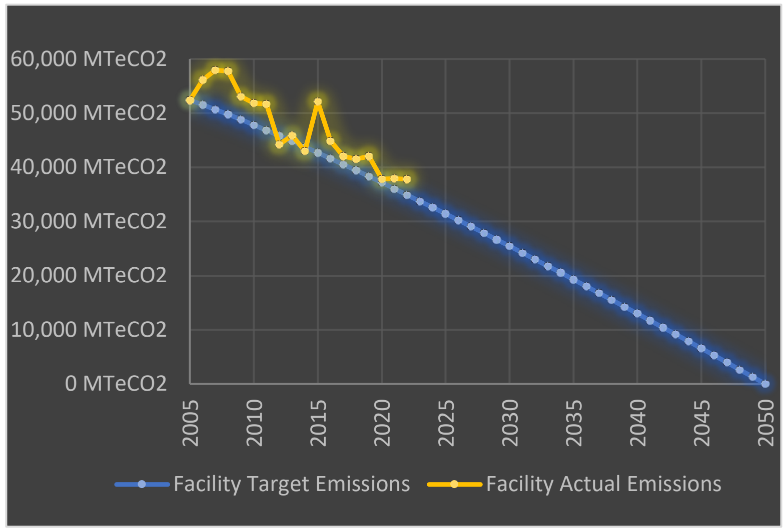
Building	Renewable Energy Provider	Funded By	Annual Electricity
10% Campus-Wide	New River Light and Power	Appalachian State University	5,000,000 kWh
5% Campus-Wide	New River Light and Power	Renewable Energy Initiative	2,500,000 kWh
Leone Levine	Blue Ridge Energy	Appalachian State University	1,610,793 kWh
App State Water Plant	Blue Ridge Energy	Renewable Energy initiative	321,000 kWh
Dark Sky Observatory	Blue Ridge Energy	Renewable Energy initiative	56,611 kWh
Sustainable Development Farm	Blue Ridge Energy	Renewable Energy initiative	26,727 kWh
Howards Creek Pump Station	Blue Ridge Energy	Renewable Energy initiative	23,573 kWh
		Total Annual Commitment	9,538,704 kWh
		ACTUAL FY 21/22 Renewably Generated Electricity Purchased (January - June 2022)	**4,769,352 kWh**

[8] GHG estimates are calculated using SIMAP® the greenhouse gas tracking tool used by Second Nature participating schools and universities.

Since these programs began in January 2022, the impact on annual GHG emissions is only for half of the most recent fiscal year. The university intends to continually increase the amount of renewably generated electricity it purchases, balancing investments in campus efficiency with annual renewable energy commitments.

Facility GHG Emissions

Figure 5. Facility GHG Emissions Compared to Net Zero by 2050



The two previous years during the height of the COVID pandemic were unprecedented in terms of campus operations. The systematic and societal changes made in response to the pandemic were significant and demonstrated the magnitude of change that is required to achieve meaningful emission reductions, which can be seen in Figure 5.

During FY 21/22, facility-related occupancy returned to pre-pandemic levels while maintaining annual GHG emissions at 37,803 eCO_2. This was a direct result of purchasing renewably generated electricity, which helped the university avoid 2,251 MT eCO2, and of the university's continued commitment to energy efficiency.

Electrical consumption during FY 21/22 in campus buildings was responsible for 22,615 MT eCO_2 while steam production was responsible for 15,188 MT eCO_2.

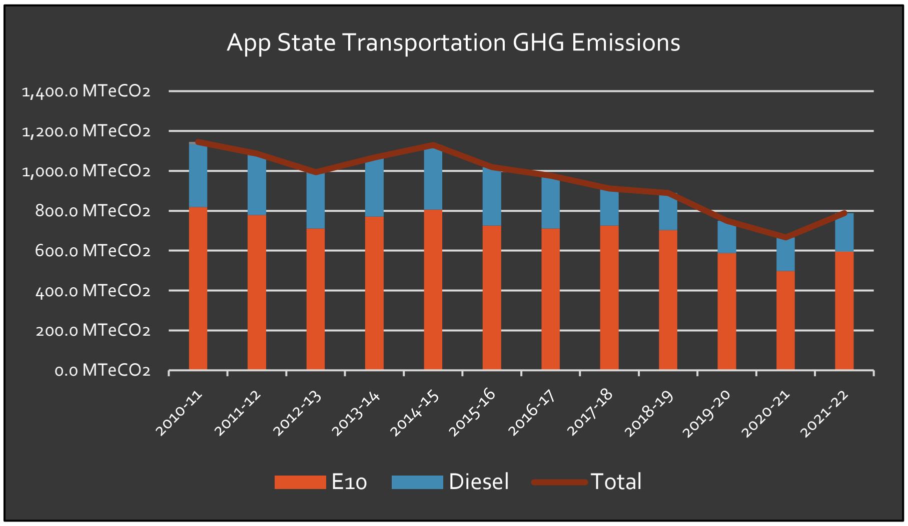
Facility GHG Goal

Despite GHG emissions not increasing with the return of a fully operational campus, actual GHG emission levels were still 2,897 MT eCO_2 above the linear emissions target goal for this past year. In order to measure progress towards climate neutrality, these annual GHG emission goals will only be attainable with significant commitments to renewably generated electricity, increased campus efficiency, and a realistic solution for delivering carbon-free space heating. For FY 22/23, the university will set a 11% reduction goal of 33,752 MT eCO_2.

Vehicle GHG Emissions

As university-related travel continues to increase with the return of campus activities, vehicle related GHG emissions have also returned to pre-pandemic levels. Figure 6 represents the university's vehicle related GHG emissions. This does not include AppalCART or NRLP since these units serve the Town of Boone and its residents beyond the university. While these reductions are on track with goals set to achieve carbon neutrality by 2050, significant investments in more efficient and/or electric vehicles will be required to make the additional reductions needed to realize carbon neutrality.

Figure 6. Vehicle GHG Emissions



Vehicle emissions increased 18% during the past year. However, when compared to FY 18/19 (the last full year not impacted by the COVID-19 pandemic), FY 21/22 vehicle GHG emissions decreased 11.3% to 788 MT eCO_2. As the university acquires new vehicles, efficiency will be a key factor in continuing the reduction in vehicles.

Electric Vehicles With a relatively low amount of required daily mileage, electric vehicles are likely suitable replacements for most daily campus activities. In order to reduce emissions and strengthen the argument for purchasing electric utility vehicles, the university has leased four all-electric vehicles (EVs) as well as several other hybrid vehicles.

Figure 7. 2019 Chevrolet Bolt at the Broyhill Wind Turbine

As AppalCART awaits delivery of its first all-electric bus, several receipt-supported entities have also adopted EVs into their fleet, including two all-electric vehicles recently acquired by Parking and Traffic and one EV purchased by NRLP. While these demonstration vehicles are a significant step forward to reducing vehicle emissions, broad adoption of heavy-duty trucks and passenger vehicles is largely dependent on the affordability and availability of commercially available options.

With a small fleet of EVs, charging infrastructure has not yet been an issue. Virtually every new EV come standard with a phase two (240v) charger which the university has installed in select locations that charge specific vehicles. There are also several charging stations available to campus parking pass holders. Once EV's are more widely adopted by faculty, staff, and students, the university will need to determine how many chargers to offer and whether or not to charge fees for that energy.

Energy and Water Use

Appalachian State University's campus is approximately 5.9 million square feet and requires significant amounts of energy and water so that occupants are comfortable and safe. Raw FY 21/22 energy and water consumption data is detailed below:

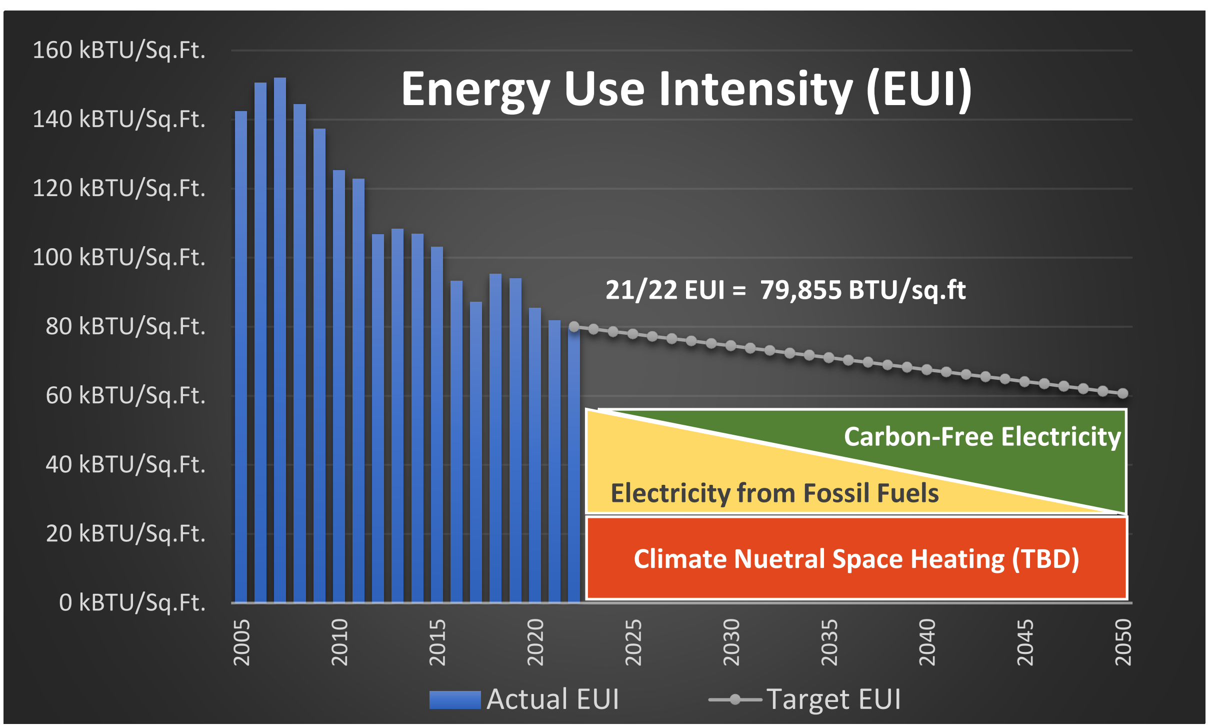
Figure 8. FY 20/21 Campus Consumption

Utility	FY 21/22 Consumption	Percent Change from FY 20/21	Percent Change from FY 18/19
Electricity	52,680,249 kWh	+11.6%	-3%
Natural Gas	2,852,516 therms	-3%	-7%
Gallons of Water	85,687,170 gallons	+36%	-4%

Energy Use Intensity

The university maintains various types of buildings (academic, housing, dining, arts, athletics, etc.). Because buildings vary in size, use, and design, comparing the amount of energy and water consumed between buildings requires establishing comparable metrics. Energy use intensity (EUI) and water use intensity (WUI) allow different types of buildings to be compared by analyzing consumption on a per square footage basis. For EUI, everything that uses energy (lighting, heating, etc.) is compared to the gross square footage of campus buildings.

Figure 9. Actual and Target Energy Usage Intensity



There is currently no shortage of efficiency opportunities at App State but determining the absolute lowest achievable EUI is based on two main factors: remaining efficiency opportunities and funding commitments. Facilities Operations has set the target EUI goal at 60,000 BTU per square foot (sq.ft.). Figure 9 shows that App State's current EUI is 79,855 BTU per sq.ft.

With campus activity returning to pre-pandemic levels and several new energy intensive buildings, long term and significant EUI reductions will be challenging. Continued commitment to energy efficiency projects will be an essential component to reducing EUI but ensuring that new construction and large renovation projects are designed and constructed with aggressive energy efficiency standards will have an even greater impact on the university's future EUI and must be prioritized.

EUI Goal for 2022/23

With adequate financial and leadership support, achieving an EUI of 60,000 BTU per sq.ft. can be a realistic goal. The required commitment will impact every building on campus. For FY 22/23, the university will attempt to reduce its EUI by 1.5% to 78,657 BTU per sq.ft.

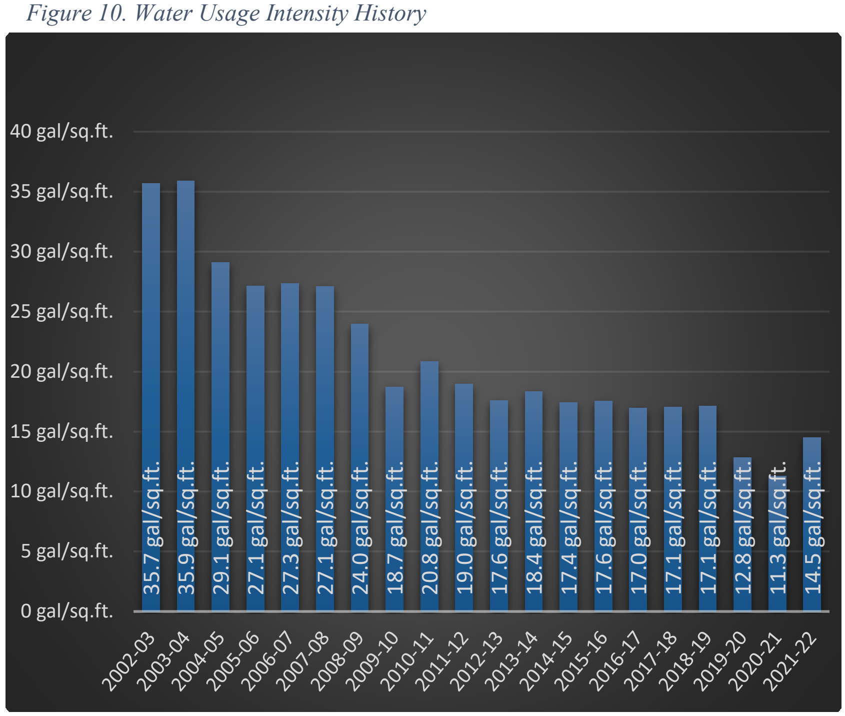
Water Use Intensity

Similar to EUI, water use intensity (WUI) analyzes water consumption across the entire campus. In this report, WUI is expressed in gallons per square foot.

Figure 10 tracks the university's WUI which has decreased significantly since 2002 due to increased attention to maintenance and installing low flow fixtures. Despite the temporary reduction during the first years of COVID, the WUI has been largely flat during recent years of full campus occupation.

FY 21/22 WUI was 14.5 gallons per square foot. This is a 15% reduction from FY 18/19 figures.

Figure 10. Water Usage Intensity History



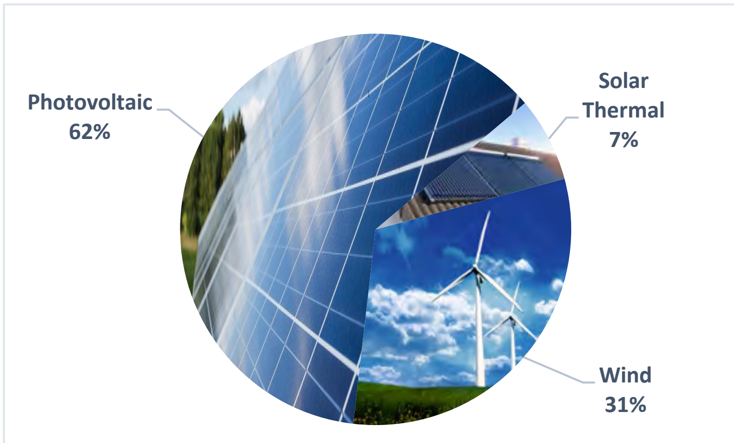
WUI Goal for 2022/23 - In order to meet long term WUI reduction goals, the FY 22/23 goal is to reduce WUI 2.5% to 13.8 gallons per square feet.

On-Campus Renewable Energy

The university has an increasing number of renewable energy systems on campus. Appalachian State University's Renewable Energy Initiative (ASUREI), a student-led, student-funded committee has been the primary funder of on-campus renewable energy installations.

In FY 21/22, on-campus renewable energy systems produced 234,808 kWh of electricity and 55.8 MMBTUs from solar thermal systems. On-campus renewable energy provided 0.18% of the university's total energy use. Figure 14 details the breakdown of on-campus renewable energy production.

Figure 11. On-Campus Renewable Energy



Unfortunately, there is significantly more solar thermal capacity installed on campus than what is being operated. The lack of utilization has been due to unanticipated maintenance costs and labor requirements to keep systems operational. Less than 10% of the total solar thermal capacity on campus was operating during FY 21/22.

Due to limited site and resource availability as well as the associated maintenance costs of wind energy, the university is currently prioritizing photovoltaic (solar-electric) as the preferred on-campus type of renewable energy system.

Opportunities – ASUREI contracted with an engineering firm to design a 99 kW PV system that is currently being installed behind the data center on State Farm Rd. Once complete, the system is expected to produce approximately 120,000 kWh annually.

Figure 12. On-Campus Renewable Energy Production 2021/22

	Annual Production
Broyhill Wind Turbine	78,300 kWh
Leone Levine Photovoltaic (PV)	83,534 kWh
Legends Electric Vehicle Charging Station PV	7,263 kWh
Library Traffic Circle PV	8,415 kWh
Frank Hall PV	52,881 kWh
Kathrine Harper/Kerr Scott PV	1,295 kWh
Peacock Mountain PV	3,120 kWh
Plemmons Student Union Solar Thermal	55,756,493 BTU

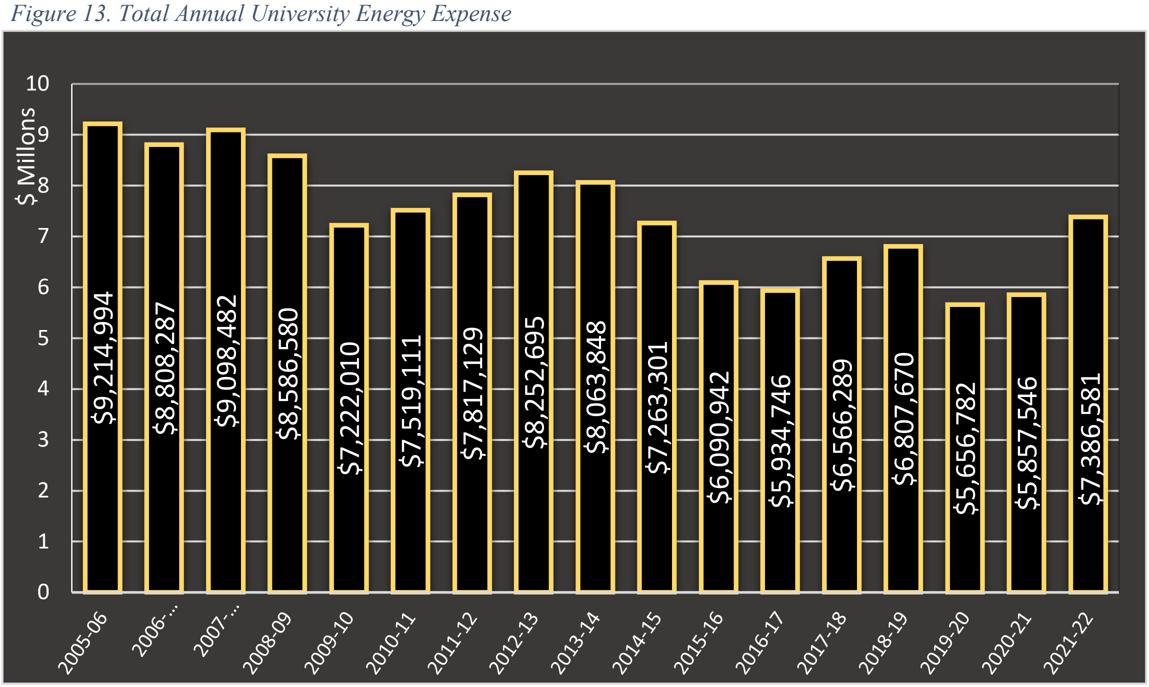
Energy and Water Expense

The amount of energy and water required by the university creates significant financial obligations and must be considered when determining future strategies. Reducing utility costs for the university helps strengthen resiliency and creates more opportunity for 1292-funded efficiency projects.

Energy

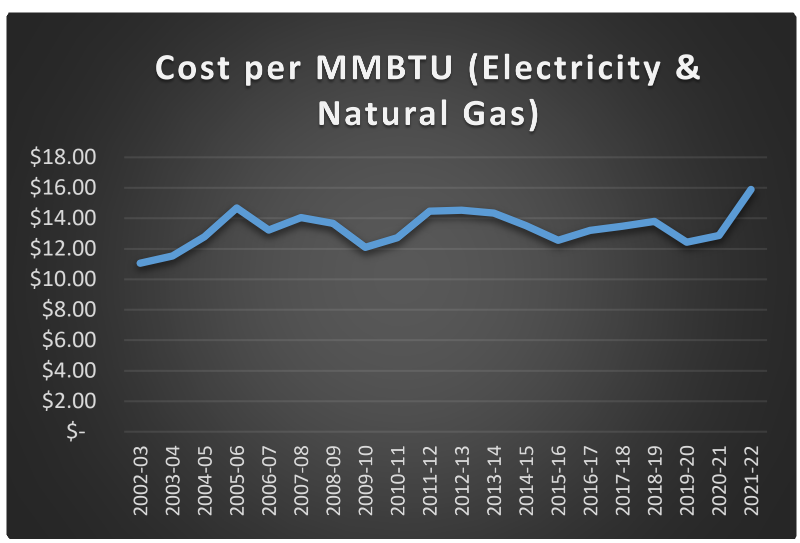
Figure 13 tracks total annual energy expense for all campus buildings. This includes the raw cost of electricity and natural gas but does not include billed rates from the steam plant that cover operating costs. Energy expenses increased significantly to their highest point since 2013-14.

Figure 13. Total Annual University Energy Expense



The cost of energy has a direct impact on the university's overall utility costs. There has been a marked decline in the amount of energy consumed but the combined cost of electricity and natural gas (measured in $/ MMBTU) has not had a discernable trend in recent years. With FY 21/22 natural gas costs more than doubling in one year, the cost per MMBTU is up considerably as can be seen in Figure14.

Figure 14. Historical Energy Cost per MMBTU



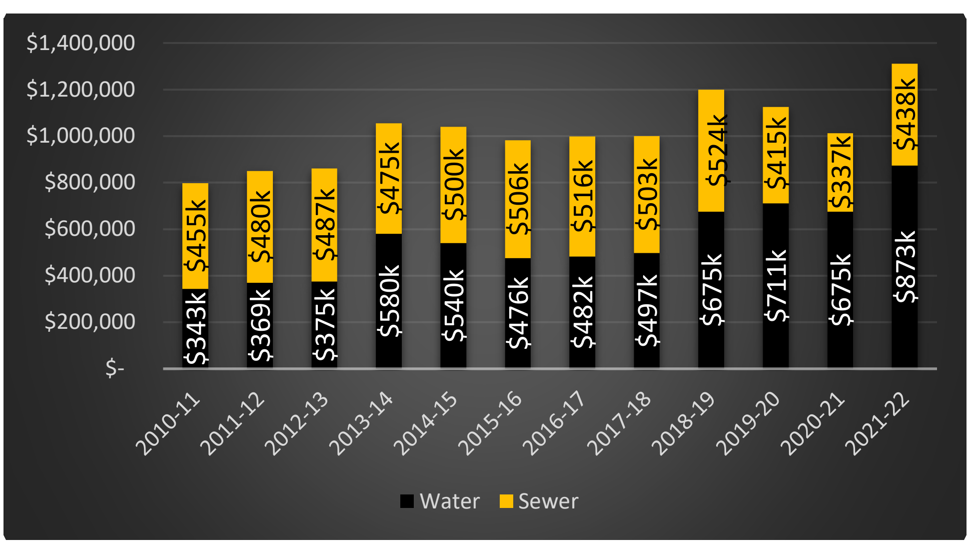
With various factors affecting cost such as fuel supply, weather, and political influences, the price of energy over the last 20 years makes predicating future energy costs difficult. The conventional assumption is that the long-term cost of energy will increase but as the adoption of renewable energy increases and as the commercially-available supply of natural resources fluctuates, predicting future energy prices remains challenging.

During FY 21/22, Facilities Operations worked with the UNC system natural gas marketer, Texican, to purchase futures that locked in approximately 50% of the university's typical natural gas consumption at $3.65 / dekatherm for 6 months through the end of the fiscal year. This strategy helped hedge against rising gas prices and saved the university $142,335 over that 6-month period. For FY 22/23, Facilities Operations has approximately 30% of typical natural gas consumption hedged at $5.30/dekatherm and is hopeful that a more favorable rate will become available sometime in the near future for an additional 30% of typical gas consumption.

Energy Expense Goal – Even with 30% of natural gas consumption hedged against rising prices, future natural gas price predictions are dependent on several factors outside the university's control. Facilities Operations will continue to seek options for hedging natural gas prices at more favorable rates. NRLP also announced a 30% increase in consumption rates to account for increased natural gas prices. With so much uncertainty, efficiency is the most reliable method for reducing energy expense. The university is also ramping up operations in its new Hickory building and there will be a new large residence hall coming on line that will impact expenses. With so much uncertainty, maintaining FY 22/23 energy expenses at FY 21/22 levels appears to be a more realistic goal than expecting cost reductions.

Water and Sewer

The university has two costs associated with the water that is consumed on campus, water supplied and sewer costs. The majority of campus receives water from the university owned and operated water plant. The Town of Boone supplies water to 14 additional meters. The Town of Boone charges sewer fees for all of the water consumed on campus whether supplied from the University or the town.



FY 21/22 water and sewer costs increased significantly as actual water consumption was up sharply compared to the previous two years when campus buildings, especially residence halls, were not at full capacity. With increased use and App State's water plant having built-in overhead and repair costs that are not necessarily correlated to the amount of water consumed, total water expense increased to its highest cost since 2009. Sewer costs, on the other hand were reduced 16.4% compared to 2018/19 levels.

Water & Sewer Expense Goal – Reduce combined costs by 3% to $1.26 million. This reduction will only be possible with increased attention towards identifying leaky systems and other efficiency opportunities in existing buildings as well as a focused water efficiency approach in new buildings and large renovation projects.

Funding Energy Projects

Limited project funding requires consideration of potential efficiency measures as well as funding sources. The following is a list of previously used and potential funding sources for on-campus energy projects.

- **Appalachian State University** – In addition to student and faculty commitment to sustainability, Facilities Operations has an engrained and pragmatic approach toward efficiency and self-sufficiency. With ongoing operations and maintenance, Facilities staff work to increase the longevity and efficiency of equipment at the university. The university's Electricians, HVAC, Controls, Mechanical, Preventative Maintenance, Zone Maintenance, Motor Pool, and Steam shops continue to provide reliable services that extend the lifespan of university-owned facilities and equipment. Facilities Operations intends to continue to make significant investments in energy efficiency as funding allows.
- **Energy Saving Performance Contracts (ESPC)** – The university has used ESPCs as a way to fund energy measures installed with no upfront cost to the university. The energy service company (ESCO) claims savings throughout the life of the contract and while this has been an effective way to get a number of efficiency projects installed on campus, actual savings have been much less than what are claimed. Since ESPCs are not responsible for maintenance, reliability and occupant comfort, university staff have devoted significant resources towards troubleshooting installed ESPC efficiency measures.

  Alternatively, efficiency measures installed by university staff have reduced energy with less overhead and have typically resulted in high occupant satisfaction and system reliability.
- **Renewable Energy Initiative (ASUREI)** – A student-funded and student-led program that implements on-campus renewable energy systems and energy efficiency projects. The ASUREI has been the primary funder of on-campus renewable energy projects and has also contributed to a large number of Facilities Operations efficiency upgrades and projects.
- **North Carolina House Bill 1292** – provides UNC system schools the opportunity to retain unspent utility funding to be used for efficiency projects. Colleges and Universities must show that the 1292 savings being claimed have been a direct result of previously installed efficiency projects on academic and administrative buildings.

  The university submitted a 1292 application for 2022/23 that identified $681k in 1292-eligible energy savings. Potential projects include: upgrading HVAC control systems, LED upgrades, window film, duct sealing, and several other projects detailed below that are intended to reduce the amount of energy consumed by the university.

Recently Completed Efficiency Projects

The following list of energy conservation measures were the most significant projects implemented during the past year. As noted, some projects will require additional work during FY 22/23. This is not a complete list of energy saving projects, as regular improvements are engrained in day-to-day operations and are difficult to capture.

- **Campus-wide temperature and scheduling policy** – despite gaining campus-wide approval from the university's Energy Council, intra-departmental complexities have prevented several buildings from adopting the 68 – 74 deg F setpoints. Despite remaining opportunities, there are several measured examples of energy reductions where this has been the only modification.
- **Building Automation System Retuning –** following guidance from Pacific Northwest National Laboratories (PNNL) BAS Retuning training as well as strategies from Life Cycle Controls and App State staff expertise, energy management staff regularly completes trend analysis to identify optimization issues. Trends that were most commonly analyzed this past year included:
    - HVAC scheduling analysis to ensure buildings are not being conditioned when mostly empty and supply and return fans are staying off for the majority of unoccupied periods.
    - Discharge air temperature (DAT) versus discharge air temperature setpoints (at the air handler) to determine if DAT resets were in place and/or working correctly.
    - Discharge air pressure (DAP) versus DAP setpoint to ensure that static pressures from air handlers were effectively being reset based on building demand for heating/cooling.
    - Optimal Start Stop (OSS) – Easily overlooked, OSS actively determines the latest possible time a building can begin cooldown/warm up. While technically existing in many buildings, OSS was not operating as intended in most buildings. Through considerable efforts of one of the Controls programmers, OSS was corrected in the following buildings: Peacock Hall, College of Education. Anne Belk, BB Dougherty, Leone Levine, Sandford Hall, and Schaeffer Auditorium.
        - For example, the six air handlers in the College of Education were scheduled to be occupied by 7 AM. The existing OSS programming was almost always going to the maximum of 2 hours and going occupied at 5 AM. Now with programming changes (looking at zone average temperature instead of single hottest/coldest zone as well as going straight to max cooling/heating), OSS has been on average 30 minutes or less even on the hottest/coldest mornings.
    - Operator Override Audits – To identify settings that were temporarily modified but unintentionally left active.
- **Anne Belk Telecom HVAC -** App State's IT department runs a central internet server in the basement of Anne Belk for 7 surrounding buildings. Air Handler One that serves that building is the largest AHU in that building and was being occupied 24/7 to keep the telecom room cool enough so that the main internet server would not shutdown. Additionally, there was no supply vent to the room that is located next to the air handler so at some point a hole was cut into the main

supply duct. This was effective in keeping the room cool but it also reduced static duct pressure for the remainder of the unit's zone. App State HVAC installed a mini split for the room and is in the process of sealing the hole cut in the supply duct. Air handler 1 is now being scheduled in accordance with the building's occupancy schedule.

- Total FY 20/21 Project Budget: $7,635
- Simple payback: 0.7 years

- **Chapell Wilson Window Film** (ASUREI funded) – With direct south/southwest exposure on half of the windows in the building, the university contracted the installation of ceramic window film.
  - Total FY 20/21 Project Budget: $17,875
  - Simple payback: 2.0 years (Energy Modeling with eQuest)
  - Additional comments: In addition to the energy savings from reduced chiller operation, wintertime convection loops from the temperature differences between outside and inside should improve occupant comfort year-round.
- **College of Education Window Film** (1292 funded) – Two sides of the building were treated with ceramic window film in an effort to reduce the demand for chilled water. Previously the building had difficulties maintain modest cooling setpoints between 73 and 74 deg F in many south and west facing zones. App State HVAC and Controls shops along with energy management staff put considerable effort into optimizing that building's systems. The window film installation is an additional measure intended to improve the building envelope and ease demands on the HVAC system
  - Total FY 20/21 Project Budget: $76,000
  - Simple payback: 4.9 years (Energy Modeling with eQuest)
  - Additional comments: In addition to the energy savings from reduced chiller operation, wintertime convection loops from the temperature differences between outside and inside should improve occupant comfort year-round.
- **DD Dougherty VAV Controls Upgrade (1292 Funding)** – Although not the highest energy consuming building DD Dougherty represents a great example of efficiency opportunities in an older building. With an entire building LED upgrade, there has been a marked decline in energy use. With the completion of the DD Dougherty VAV Controls project, App State can implement its most aggressive controls sequences that include: demand-based ventilation, discharge air temperature resets, static pressure resets, hot water resets, chilled water differential pressure reset, improved scheduling functionality, and improved remote monitoring/diagnosing.
  - Total FY 20/21 Project Budget: $89,235
  - Estimated annual avoided energy: 45,455 kWh and 361 MMBTU of steam
  - Simple payback: 4.2 years

- Additional information – Phase 2 of the project will include replacing remaining pneumatic components which will increase energy savings. Likely funded with anticipated future 1292 funding.

- **Belk Library N2 Upgrade – Phase 1** (1292 Funded) – The university began purchasing materials to upgrade the Belk Library outdated building automation system communication protocols from N2 to BACnet. These upgrades will allow App State Controls Shop to implement numerous control strategies that will reduce energy se including: discharge air temperature resets, static pressure resets, hot water resets, chilled water differential pressure, improved scheduling functionality, and improved remote monitoring/diagnosing.
    - Phase 1 Cost: $90,650
    - Energy Savings – Please see phase 2 in the following section.
    - Materials purchased included: JCI controllers, input/output modules, BACnet controllers (171 out of 289 needed) and room sensors with temperature, relative humidity, and carbon dioxide (171 out of 289).
    - Phase Two will include ordering the 118 remaining VAV controllers and room sensors. App State will complete the installation and programing of this equipment in-house with the controls shop.

- **Holmes Convocation Center Lighting Upgrade** (1292 Funded) – Appalachian State purchased and installed over 1,300 LED fixtures in the second highest energy consuming building on campus. This initial phase of the project upgraded 90% of the building. With anticipated future 1292 funding, Facilities operations will complete the lighting upgrades for the entire building.

  Project data:
    - Total Project Budget: $145,070 (Phase 1) + $24,899 (Phase 2) = $169,969
    - Estimated Avoided Annual Energy: 262,261 kWh/year
    - Estimated Simple Payback: 6.5 years

  This building was selected for LED upgrades primarily because of:
    - The long daily operating schedule;
    - The building did not receive lighting upgrades from either performance contract and the standard ballast factor maximized payback.

  Additional comments: This project was a large push for in-house electricians with competing priorities. University preference is for in-house installation because of associated cost savings but also because of the high quality of work. App State did have to contract with local electricians to complete some of the work and was a good example of how some projects can be completed by combining in-house and contracted resources.

- **Steam Meters Academic Buildings -** If the university cannot accurately measure building specific steam use, steam energy cannot be effectively managed. Existing condensate meters are hand read and go through four different staff before being analyzed on a monthly basis. This makes making financial efficiency decisions challenging as a number of buildings have inconsistencies with their monthly readings.

The university's two existing performance contracts included ECMs that installed Spirax Sarco steam meters. After two years, the meters were excluded from the contract because the ESCO was not confident in the data being used. Many of those meters were not serviced and most were never brought into the building automation systems. This project was broken down into two categories:

- Survey of Existing Meters – App State contracted with Spirax Sarco to inventory existing meters to determine which ones were still reliable and could be recalibrated. Of the 30 meters surveyed, 19 were determined to be capable of being brought back into service. App State Controls shop is in the process of connecting these meters to the BAS. This will allow much more impactful energy management.
- Purchased 11 new meters – Endress & Hauser won the competitive bid process and App State is currently in the process of installing these meters. Half were contracted out to a local installer and half will be competed in house with non-1292 funding.

- **Pipe Insulation – Multiple Buildings** – Funded by both Facilities Operations and the ASUREI, several pipe insulation improvement projects were completed. These include pipe insulation on steam, hot water, and chilled water lines. Additionally, App State has begun reinsulating deteriorated insulation on chillers. Primarily using the software 3E Plus V4.1 to verify cost effectiveness, virtually every campus pipe insulation project has a payback of less than 1 year, even with being installed by an outside contractor.
- **ASUREI Data Center PV Array** – Completely funded and designed under the leadership of committed students, this 99-kW photovoltaic solar array began construction and is expected to be completed during the fall of 2022. The array is behind the university's main data center which consistently has a load of approximately 90-100 kW.
    - Estimated annual output: 120,000 kWh

Anticipated 1292 Projects – FY 2022/23

The following projects are currently being developed and will be funded with 1292 carry forward funding. Budgets are estimated with as up to date material and labor costs as possible but depending on bids and material availability, projects are subject to change.

- **BB Dougherty Window Film**
  - Objective: Apply ceramic window film to the east, south and west sides of the building to reduce solar heat gain and chilled water demand while also minimizing wintertime convection loops that impact occupant comfort.
  - Estimated Cost: $40,049
    - Total glazing square footage = 3,080 sq.ft. x $13/sq.ft.
  - Energy Saving Payback: Energy modeling of several campus buildings have yielded estimated paybacks between 2 to 6 years. Based on the buildings positioning, building envelope condition, and occupancy hours, App State is assuming a conservative payback of 5.0 years.
  - Additional information: After a thorough analysis of commercially available products, App State has been applying Huper Optik C35 Ceramic Window Film (or similar) to several buildings that commonly experience high solar heat gain and have high chilled water expenses. This project will be put out to bid and have various requirements (e.g. 20-year warranty, $2,000 per pane coverage, and previous experience completing projects in the UNC system) to ensure that university receives quality installation.

- **Belk Library N2 Upgrade Phase 2**
  - Objective – The library's building automation system operates using the outdated communications protocol, N2, that limits several energy efficient control strategies. These upgrades will allow App State Controls Shop to implement numerous control strategies that will reduce energy use including: discharge air temperature resets, static pressure resets, hot water resets, chilled water differential pressure, improved scheduling functionality, and improved remote monitoring/diagnosing.

    Phase 2 of the project includes purchasing the remaining x118 VAV controllers and room sensors that monitor temperature, relative humidity, and carbon dioxide. Phase 2 includes installation of these materials as well as materials that were purchased with FY 2021/22 carry forward funding.
  - Estimated Cost - Phase 2: $139,326

        - Materials - $93,226
        - Labor (Mix of In-house with some outside contracting support) -$46,100
    - **Energy Savings –** Combined Phase 1 & 2 = 76,953/year
        - Air Handlers Supply & Return Fans (x4) – Average Electrical Demand = 29 kW
            - Annual operating hours: 6,752 hours
            - Existing AHU electrical consumption: 216,064 kWh
            - Estimated electrical energy reduction: Assuming conservative reduction of 35% = 75,622 kWh x $0.0996 = $7,531/year
        - Annual Steam Consumption
            - Existing = 4,822 MMBTU/year
            - 30% Steam Reduction = 1,446 MMBTU x $48.01/MMBTU = $69,422
    - **Payback =** 2.9 years with total cost for phase 1 and 2 of $229,976

- **Belk Library LED Upgrade**
    - Objective: Upgrade the existing fluorescent T8 lighting to LED throughout the entire building. This building currently has over 8,000 single 4ft T8 bulb, nearly 800 2'x2' T8 troffers, and nearly 500 other lighting fixtures. The library generally operates 24 hours a day, 5 days a week and at least 16 hours on the other two days. This project will include a significant amount of de-lamping over the stacks and dual technology occupancy sensor switches with dimming capabilities in offices, study rooms, and other similar areas.
    - Estimated Cost: $228,223
    - Energy Savings: 487,536 kWh/year
    - Payback: 5.1 years
    - Additional: Successful implementation of this project within FY 22/23 will require labor from both in-house and contracted electricians. Work will be primarily completed during winter and spring breaks when the library is closed. Work in non-student occupied areas will be completed throughout the year.
- **Convocation Center LED Upgrade – Phase 2**
    - Objective: The initial phase of the Holmes Convocation Center LED project upgraded 90% of lighting during FY 21/22. This second phase will complete the project.
    - Estimated Cost: $24,899
    - Energy Savings: Please see phase 1 calculations

- **DD Dougherty – Finalize Controls Upgrade & Eliminate Pneumatics**
  - Objective: Complete the building's digital controls upgrade.
  - Estimated Cost: $13,520
  - Energy Savings: Separate from the calculations made above, this final upgrade process will eliminate all pneumatics so the building will not require compressed air. Additionally, there will be several AHU control strategies that will be implemented.
  - Payback: 4.2 years
- **Leone Levine Condensing Boiler Modification**
  - Objective: there are four natural gas-fired boilers that heat the Leone Levine building that is located in Boone but not on the main campus. During construction, the boilers were constructed so that the maximum efficiency possible is 85% even though the rated efficiency is 96%. This goal of this project is to coordinate with the mechanical engineer who designed the system (out of warranty period) and determine required modifications to increase efficiency.
  - Estimated Cost: $24,000 – Consult with mechanical engineer, materials and installation
  - Energy Savings: An increase in 12% efficiency would save 5,864 therms of natural gas/year.
  - Payback: 3.88 years
- **Pipe Insulation (Multiple Buildings)**
  - Objective: Continue to improve the existing condition of pipe insulation on various campus mechanical systems. include pipe insulation on steam, hot water, chilled water lines, and chillers. The majority of pipe insulation that is installed is permanent but on equipment that receives regular service (e.g. valves, meters, etc.), removable custom blankets will be applied.
  - Estimated Cost: $29,086 has been allocated
  - Payback: 1.0 years or less. Confirmed using 3E Plus V4.1
- **Rankin North – Duct Sealing**
  - Objective: Deal HVAC ducts to improve the efficiency of the system that operates 24/7, every day of the year. Rankin North's fume hood system and the vivarium with living animals requires constant flow and temperatures. On the supply side, duct sealing will more efficiently deliver air where it is intended to go. On the exhaust side, duct sealing will prevent excess conditioned air from being exhausted outside.
  - Estimated Cost: $77,000
  - Energy Savings: 20,829 / year
  - Payback: 3.7 years

- Additional: This project will be completed Aeroseal who uses an aerosolized sealant from the inside of HVAC ducting.

Additional Potential Energy Projects

The following list of projects have been identified as potential measures the university can pursue to reduce energy consumption and overall utility costs. This list is not intended to be either a complete list or serve as a list of known projects. Energy saving potential, cost effectiveness, funding, and labor availability will be considered when prioritizing and selecting projects.

- **Building Submetering**
    - Install power and steam meters in campus. By installing meters that interface with the university's building automation system, Facilities Operations will be able to track energy usage in real time, reduce response time to problem areas, and implement demand management strategies.
    - *Challenge* – Implementing a preventative maintenance plan to ensure long term accuracy of meters.

- **Chilled Water System Optimization**
    - Calculate and evaluate KW/ton for each chiller (should be less than 1.0) and prioritize chilled water systems based on efficiency and operating costs.
    - Energy management team will consider: pump speed control, whether or not a differential pressure reset is being used, temperature difference (Delta T) between supply and return temperatures on secondary and tertiary pumps, and any VFDs not actively modulating.
- **Demand Controlled Ventilation** (DCV)
    - DCV represents an opportunity to reduce energy use and improve indoor air quality. By installing zone sensors that measure carbon dioxide, humidity, and temperature, Facilities Operations can modulate the amount of incoming outside air based on the actual number of occupants in a room. During unoccupied periods, DCV will allow FO to monitor and respond to relative humidity.
    - *Challenge* – Accuracy on Sensors – If programming of sensors is driven by a single zone's maximum reading, one faulty sensor could drive outside air rates. Additionally, because older buildings have lower designed outside air rates, sensors are needed in every zone and FO would need to implement a sensor maintenance plan.

- **Building Re-Tuning**
    - o Continue actively monitoring building performance. Buildings are prioritized by highest utility costs and follow Pacific Northwest National Laboratory's Building Retuning program.
- **Pipe Insulation**
    - o Identify piping that need insulation. Steam, condensate, chilled water pipes continually receive maintenance and often insulation is either damaged or not replaced. The university does not employ insulators and currently has to contract out work which can be cost prohibitive.
- **LED Upgrades**
    - o Appalachian State University is committed to upgrading all campus lighting to LED. In order to be cost effective, App State intends to complete as much work as possible with in-house electricians but expects to have to contract out some of the work. As more buildings are upgraded, the university will get to buildings that have had upgraded fluorescent ballasts with low ballast factors, increasing payback. App State still intends to upgrade to LEDs but this will require consideration to decrease project costs.

    - o *Lighting Controls* – Most of the university's lighting is either controlled by conventional on/off switches or occupancy sensors that are not connected to the building automation system. Going forward, the university will likely install occupancy sensor switches with dimming and daylighting capabilities.

Other HVAC & Controls

- o Beginning with the College Street Chiller Plant, test sequence of operation control for free cooling using existing plate and frame heat exchanger during winter so that chillers can be turned off seasonally. *Challenge* – mitigate freezing concerns by using belt driven cooling tower in reverse.
- o Building Pressure Setpoints – Most buildings contain building pressure setpoints so that buildings are slightly positive. There is not a standard setpoint and there may be efficiency opportunities by identifying a standard minimum building pressure setpoint.
- o Discharge Air Temperature and Static Pressure Resets – Determine which buildings could incorporate or improve these reset strategies.
- o Hot water resets – Determine which buildings could look at zone need rather than outside air temperature to reset the hot water supply temperature (typically between 120 and 180). Requires a digital thermostat in each zone.
- o VAV Box Occupancy Sensors – Currently Installed in Peacock, Anne Belk, Leon Levine, and Sanford Hall. Determine maximum temperature drift (1.5 deg F) and minimum flow (not 0 CFM) to increase efficiency and minimize comfort concerns.

- Investigate overcooling to determine if modifying minimum occupied flow setpoints can reduce overcooling and save energy without impacting occupant comfort. ASHRAE (2019) suggests that minimum flow setpoints should be closer to minimum ventilation rate calculations (typically 10 to 20% of designed maximum flow).

- Warm / Cool Adjusts – Determine if there are any remaining warm/cool adjusts that can override campus temperature policy. Also determine if warm/cool adjust should remain active if temperature adjustments can only increase efficiency (I.e. if they do not make a room any cooler during the summer, only warmer)

- **Steam Efficiency**
  - Determine if installing an economizer on the number 4 steam boiler is a viable project given life expectancy of boiler.
  - Repair and/or improve pipe insulation in numerous campus buildings.
  - Identify areas where condensate return could be improved.
  - Continue testing steam traps repair as needed.
  - Test all heat exchangers.
  - Scan all high, medium, and low-pressure steam valves and lines ultrasonically for leaks. Repair when practical.

<u>Building Specific Opportunities</u> (alphabetical order)

- **Anne Belk**
  - Balancing air handlers – AHU 1 serves the majority of this building. There are several duct sealing and building envelope opportunities that would allow AHU 1 to reach the desired building pressure setpoint.
  - Chiller Optimization - Implement improved hot water reset for pneumatically-controlled spaces. Need to determine feasibility of creating a new sequence and disperse several wireless DDC thermostats for zone verification and temperature protection.
- **BB Dougherty**
  - Chiller replacement upgrade. This project would also represent an opportunity to switch to a more benign refrigerant.
  - Determine if AHU 2 outside air intake can be increased to increase economizing capability.
- **Belk Library**
  - Determine how the dampers on the heat wheel bypass can be better sealed.

- Review existing demand limiting load rolling programing and enable.
- Conduct a thorough pipe insulation analysis and repair insulation as needed.
- Occupancy control on HVAC & lights in study rooms

- **Bookstore/College Street Chiller Plant**
  - Utilize free cooling via plate and frame heat exchanger. Mitigate freezing concerns with new sequence of operation that uses belt driven cooling tower in reverse. This would allow turning off the chiller during the winter.
  - Potential controls modifications: implement variable condenser water flow, condenser water temperature reset, and chilled water reset.
  - Chiller loop extensions - utilize shared chillers with varied chiller sizes to keep chillers running in optimal range.
  - Replace remaining Metal Halide light with LED
- **College of Education**
  - Duct Sealing – Especially at AHU 5 – who has a static pressure reduction over 50% from the AHU to the fifth floor.
- **Dining Hall**
  - With an additional network engine, there are various building automation control strategies that could be implemented such as reprogramming older N2 VMA programming and improve hot water resets.
- **Garwood Hall**
  - Determine optimization/alternative options for distilled water system.
  - Consider expanding Events2HVAC beyond basic classrooms. Would have to be done in coordination with Phoenix fume hood system.
  - Chilled water reset - Would require installing zone humidity sensors in rooms
  - Improved hot water and chilled water resets.
  - LEDs are currently only installed in the first-floor hallway have been upgraded. Existing T-8 fluorescent bulbs are part of the second performance contract but since the building is consistently the top energy consumer on campus, need to conduct cost benefit analysis considering 7 remaining years of contract payments.
- **Holmes Convocation Center**
  - Occ Sensors for the arena game lights, x6 AHUs and two destratification fans. These sensors were purchased with FO funds in 20/21 but have yet to been installed.
  - Install digital pre-heat valves (ball) on the AHUs. This would prevent steam from leaking through causing more load on the chillers.

  - Determine chiller optimization potential as well as hot water reset options.
  - Long Term: Advocate for roof replacement and insulation improvement (currently less than 4” of XPS on sloped areas). Would reduce energy costs, mitigate condensation issues, and serve as a potential location for roof top solar (with a standing seam roof and minimal required roof penetrations.

- **John E. Thomas**
  - Upgrade 172 VAV boxes form pneumatic to digital for increased control strategies. During 21/22, the controls shop is upgrading boxes in DD Dougherty which has less than a third of the boxes that are in this building and will serve as an excellent training opportunity.
  - Chiller replacement would serve as an opportunity to reduce energy consumption and switch to a more benign refrigerant.

- **Kathrine Harper Hall**
  - Mechanical Room – Relocate or section off IT equipment that is located in the mechanical room that stays above 80 degrees. Currently there is a Cool Cube 10, 10,000 BTU/hr. capacity (10amps x 115 v) running 24/7.
  - Upgrade all lighting to LEDs – Part of the first performance contract, the final payment will be made in April of 2022. Based on the use of the building, occupants are present late in the evenings using various labs and often lights are left on overnight.

- **Kidd Brewer Stadium**
  - Install ceramic window film on east (field facing) and west windows. East windows would likely only need films on the 6 & 7 floors as awnings block majority of direct sun on lower levels.
  - Break HVAC schedules into additional zones and schedule accordingly.
    - 6th floor separate game suites and offices. Game suites do not need to be continuously conditioned. 7th floor except for telecom in suite 7026. Consider adding mini-split unit.
  - Program / schedule two AHUs not currently controlled by BAS. Determine if bringing into BAS is practical or if scheduling at existing Trane thermostats is possible.
  - Determine if retuning opportunities exist with DAT and SAP resets, ERV operation, and other potential optimization modifications.

- **Leon Levine**
    - Address overcooling that is evident. Consider reducing occupied minimum flows while balancing occupant comfort and ventilation requirements.
    - Consider installing ceramic window films on exterior of building. Even though some areas are over cooled, there are others that receive a significant amount of solar gain.
- **LS Dougherty**
    - Add controllers to bring mini-spilt systems that condition offices on exterior walls into Metasys.
    - Consider window replacements. Existing windows are single pane and many cannot properly close.
- **Peacock**
    - Continue to monitor preheat valves for failure. Consider upgrading to digital valves. Primary issue is to determine why preheat valves continue to fail. Even though there is higher incoming steam psi, valves are rated for this pressure.
    - Survey airflow setpoints (minimum and maximum), especially in DDC rooms.
    - Consider installing ceramic window film on exterior glazing. Building has poor thermal envelope. Options for insulating exterior walls are limited.
- **Plemmons Student Union**
    - Incoming outside air for AHU 1 uses an uninsulated wall chase and warms incoming OA. Example - When the actual outside air temperature was 36 degrees F, the incoming outside air temperature sensor read 56 degrees F.
- **Rankin West**
    - With the recent chiller r'newal completed to prolong life of unit and bring equipment back to manufacturer's specifications, need to determine what optimization strategies exist.
    - Determine if abandoned make up air unit (with functioning steam preheat) could be incorporated to increase the amount of outside air and increase economizing capability.
- **Rankin South**
    - Determine if building can be scheduled with a nightly static pressure reset or similar.
- **Shaefer Auditorium**
    - Determine feasibility of using free cooling during winter months by enabling the chiller's plate and frame heat exchanger. Determine if cooling tower is belt driven and capable of being operated in reverse.

- **Student Recreation Center**
  - Determine feasibility of improving hot water and chilled water resets
  - Obtain a quote for adding a preheat coil after the cooling coil on AHU 3. This could improve economizer and dehumidification operations.
  - DHU's have third party controls with minimal modifications by University Control's shop. Determine potential for optimization.
  - Circulation pump for the pool operates under manual control (third party controllers).
  - Install safe access to outside air intake to allow for regular cleaning of intake. Currently not safely accessible and intake is clogged.
- **Varsity Gym**
  - Intakes for six air handling units in main gymnasium need to be deep cleaned to minimize flow restriction.
  - Bring mini-splits that serve the staff gym into Metasys.
- **Walker Hall**
  - Improve indoor air quality, occupant comfort, and energy efficiency by increasing the amount of outside air, balance system, and increase thermal storage to reduce the number of times the chiller operates.

Campus-Wide Potential Water Projects

- Evaporation credits - Included in one of the university's ESPCs, the university has yet to realize the savings associated with sewage fees being based on the amount of water supplied to cooling towers. While some new metering may be required, determine if there is a path forward with the Town of Boone as evaporation credits would represent a low-cost financial savings opportunity that is common practice for large facilities.
- Conduct campus-wide water audit, identify building specific water efficiency measures, and prioritize project proposals.
- Low flow fixtures - Update urinals and toilets to low-flow fixtures in new buildings and major renovations. A number of older buildings' sewage systems may not be well-suited for ultra-low flow water devices. Buildings must be evaluated on an individual basis.
- Scheduled test and tunes to ensure toilets, urinals, and faucets are in good order and operating at peak efficiency. This process would be performed once a year in each building on a rotating basis.
- Determine feasibility of closed loop HVAC options that would reduce consumption.

ECU Strategic Energy & Water Plan (2022-2023)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

General

The preparation of the 2022 - 2023 ECU Strategic Energy and Water Plan involved consolidating responses by the departments in Campus Operations related to procedural changes or projects that contributed to the conservation of energy or water. This year's plan documents Campus Operations' successes related to energy and water conservation based on the availability of funding sources, be they operating, repair and renovation, or energy savings carry forward.

Analysis

Through the continued efforts of Campus Operations and the East Carolina University community, the institution has realized a 31% decrease in its energy consumption and a 53% reduction in water consumption in 2021-2022 from the FY 2003 baseline. When compared to the previous year, electrical consumption increased 2.5% per gross square foot while natural gas usage increased by 1.0%. A portion of these increases are due in part to ECU constructing the new Life Sciences and Biotechnology Building. The 139,771 square foot laboratory and research building has domestic hot water and heating provided by natural gas fired boilers. The air conditioning is provided by chilled beams with displacement air, conditioned by 100% outdoor air units. Chilled water is provided by a central chiller plant, and energy recovery is provided by water coils in the exhaust air stream.

"The institution has realized a 31% decrease in its energy consumption and a 53% reduction in water consumption since our FY 2003 baseline"

There was a leak in the natural gas line that feeds the main campus steam plant, requiring a switch to fuel oil for a period during October 2021, contributing to an increase in #2 fuel oil usage in FY 21/22. Although the energy content of fuel oil compares favorably with natural gas, it is significantly more expensive and has a greater negative impact on ECU's "carbon footprint".

The energy consumption data included in this report is "raw" metered data (i.e., it does not take temperature variations into account). To better appreciate ECU's effort to improve energy efficiency, the top chart on page 4, "ECU Annual Energy Consumption" includes a weather-normalized view of the total energy usage per square foot. The weather-normalized EUI (Energy Utilization Index) shows a decrease of 4.7% since our 2002-2003 baseline. Over this same period, we experienced an increase in the campus gross square footage of 64%.

"When compared to the previous year, electrical consumption increased 2.5% per gross square foot, while natural gas usage saw a 1.0% increase"

During FY 2022, ECU completed the optimization of Central Chiller Plants 1 and 2. Part of the optimization was to re-establish water side economizing in Central Chiller Plant 1. This optimization should reduce energy required to produce chilled water.

Energy Carry Forward (ECF) funds were utilized to continue the optimization of the Brewster Building. Constructed in 1970, this 118,456 gross square foot building is organized into four distinct wings. The project was phased over four years, started with the B-wing three years ago, followed by the C-wing, D-wing, and the A-wing this year. This optimization project will replace the obsolete pneumatic controls with new electronic controls that will enable us to setback during holidays, weekends, and periods of lower occupancy.

Excluding the COVID period anomaly, ECU continued to drive down water usage per gross square foot, reaching our highest level of reduction since our baseline year of 53.4% since the 2002-2003 baseline. Rain Bird Smart Irrigation Controllers were continued to be deployed with this last year being installed on our largest lawn area on Main Campus, which is referred to as The Mall. This will enable our grounds team to optimize the irrigation program as this system utilizes weather and evapotranspiration data to automate the irrigation schedules.

"ECU continued to drive down water usage per gross square foot, reaching our highest level of reduction since our baseline year of 53.4% since the 2002-2003 baseline."

ECU continued replacing the failing steam infrastructure serving our College Hill housing neighborhood, completing the first phase earlier this past fiscal year with two more phases scheduled to begin construction this FY. These projects have replaced the old, deteriorating lines with new, pre-insulated ones that will improve condensate return to the plant and reduce our energy losses in transmission.

On October 29, 2018, Governor Roy Cooper issued Executive Order No. 80 establishing targets for Greenhouse Gas emission reductions throughout North Carolina. One of the order's specific actions directs a 40% reduction in energy consumption (per square foot) of state-owned buildings by the end of fiscal year 2025. The baseline continues to be our FY 2003 level. Most recently, in January of this year, Governor Roy Cooper issued Executive Order No. 246, affirming North Carolina's commitment to a clean energy economy and directing next steps in the state's plan to achieve net-zero greenhouse gas emissions and create economic opportunities across the state of North Carolina. This increased the statewide goal to a 50% reduction from the 2005 levels by 2030 and achieving net-zero by 2050.

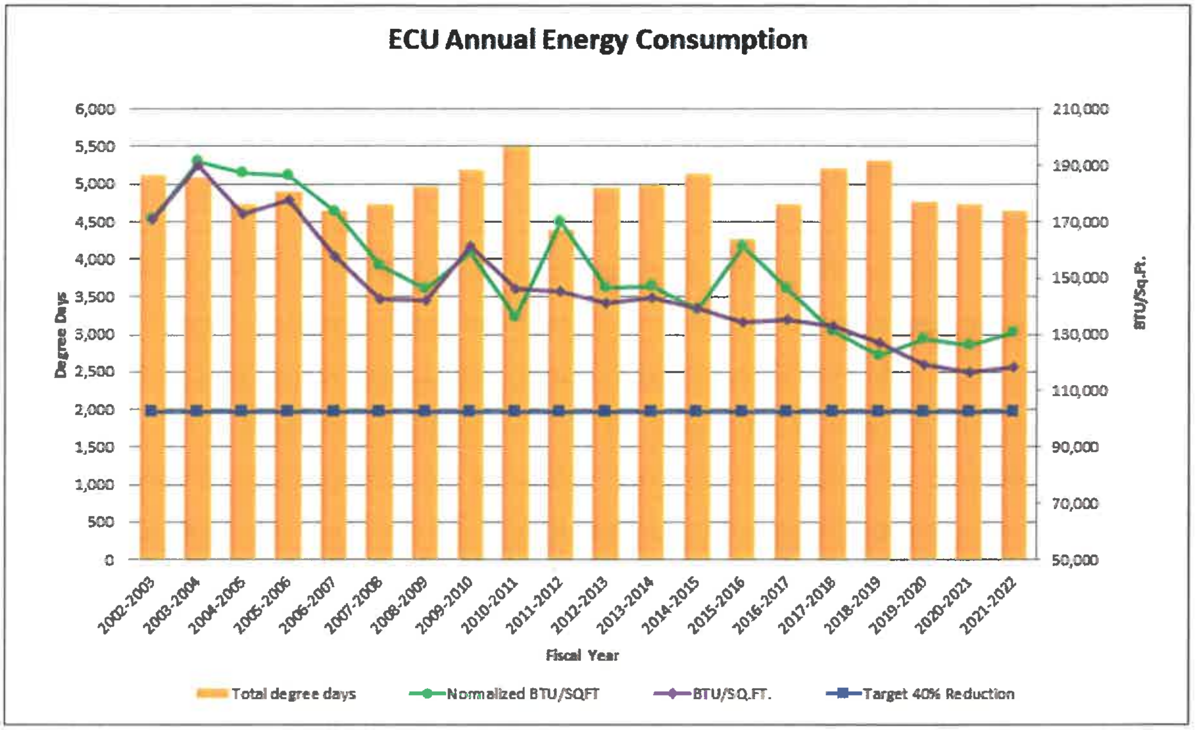
For ECU to achieve targeted energy consumption goals, substantial reductions must still be realized. These reductions will require both the continued replacement of less efficient equipment utilized on campus as well as making behavioral changes in how campus facilities are operated. Over the next twelve months, ECU will continue to pursue equipment upgrades, retrofits, and conversions, while also ensuring the campus is operated as efficiently as possible. These endeavors will be undertaken without compromising our primary missions of education and research. This will include such actions as continuing to establish and maintain building operating schedules and defining optimal building operating parameters for energy intensive locations, such as research labs. These efforts, combined with continued campus community education and involvement, will continue to allow ECU to move closer to targeted reductions.

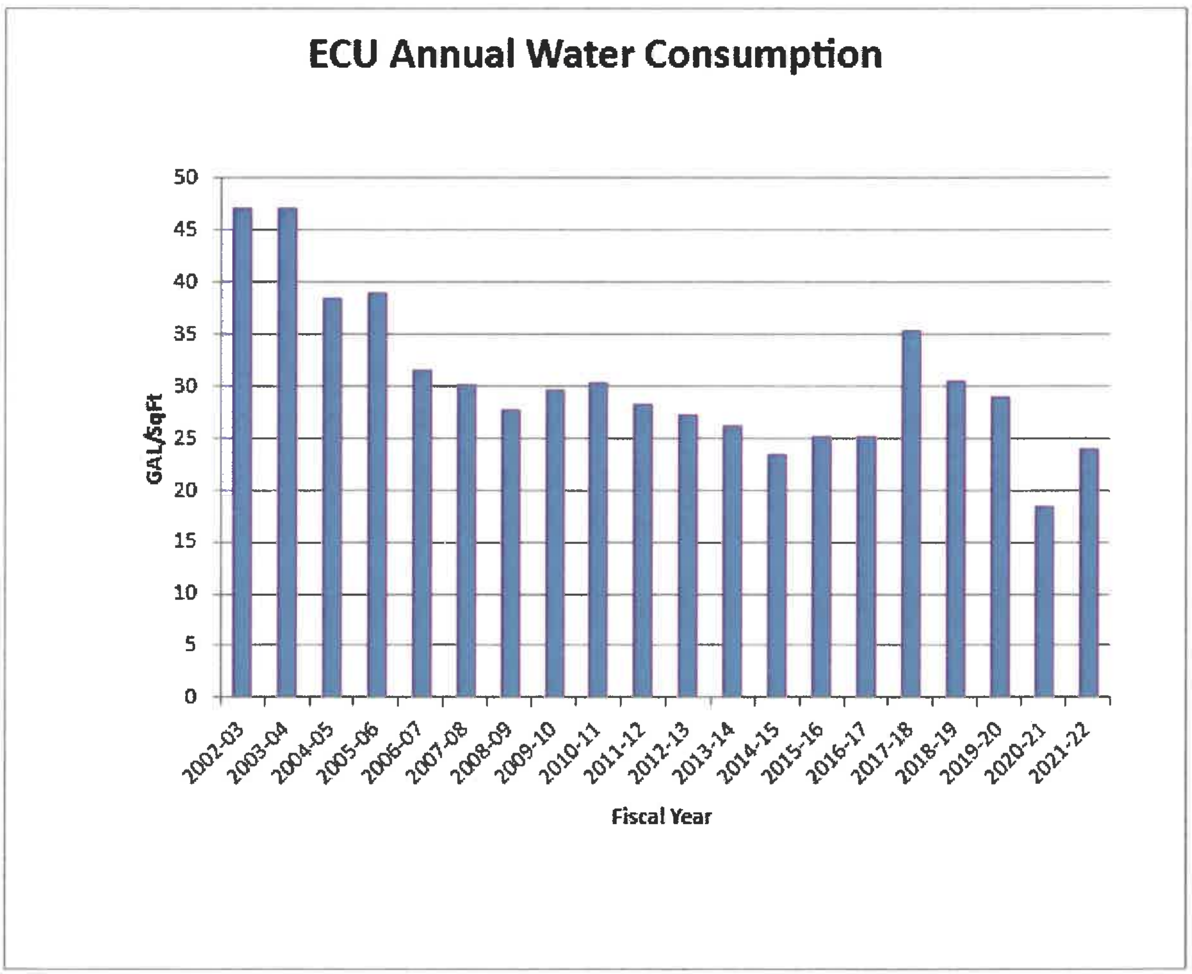
Griffin Avin
Chief Sustainability Officer

Paul Carlson
Interim Energy Manager

Chad Carwein
University Sustainability Manager

Summary of referenced data





ENERGY PERFORMANCE SUMMARY

(Data is not weather-normalized)

Fiscal Year	Total Utility Costs	Cost / MMBTU	Cost / GSF	BTU / GSF	% Change from 2003
2002-2003	$11,021,822	$12.50	$2.13	170,724	-
2003-2004	$12,661,561	$12.32	$2.33	189,287	10.9%
2004-2005	$14,277,138	$14.29	$2.47	172,569	1.1%
2005-2006	$17,129,124	$16.66	$2.96	177,567	4.0%
2006-2007	$17,297,153	$16.30	$2.56	157,404	-7.8%
2007-2008	$17,569,897	$17.14	$2.44	142,573	-16.5%
2008-2009	$18,924,248	$19.16	$2.72	142,207	-16.7%
2009-2010	$19,658,784	$17.71	$2.86	161,238	-5.6%
2010-2011	$18,392,943	$17.84	$2.61	146,059	-14.4%
2011-2012	$18,151,180	$17.58	$2.56	145,433	-14.8%
2012-2013	$17,942,582	$17.15	$2.42	141,416	-17.2%
2013-2014	$17,883,685	$17.13	$2.43	141,752	-17.0%
2014-2015	$18,628,334	$17.97	$2.51	139,480	-18.3%
2015-2016	$16,361,605	$15.93	$2.14	134,410	-21.3%
2016-2017	$15,864,576	$15.35	$2.08	135,262	-20.8%
2017-2018	$15,364,652	$14.88	$1.98	133,158	-22.0%
2018-2019	$16,022,036	$15.18	$1.93	127,096	-26.0%
2019-2020	$15,604,175	$15.50	$1.85	119,270	-30.1%
2020-2021	$14,372,208	$14.96	$1.72	116,452	-31.8%
2021-2022	$17,037,778	$16.66	$1.97	118,377	-30.7%

SUPPLY

Strategies

- Continue to implement programs and initiatives to make University's energy management more effective.
- Strive to obtain reasonable cost of interruptible natural gas from local provider.

Tactics

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Schneider Electric PME Technical Support	Subscription renewed	Subscription renewed	$0	$0	$15,000	0	Griffin Avin	FY 2021 HB1292 Funds
Dude Solutions Technical Support	Subscription renewed	Subscription renewed	$0	$0	19,464	0	Griffin Avin	FY 2021 HB 1292 Funds
Completed interviews for Energy Manager	Position approved	Interviews Completed	$0	$0	N/A	1	Griffin Avin	Campus Operations Funds
Submitted justification document for Energy Analyst and Sustainability Outreach Specialist positions	Position approved	Under Review	$0	$0	N/A	2	Griffin Avin	Campus Operations Funds

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Schneider Electric PME Technical Support	Subscription renewed	Renewal in process	$0	0	$15,000	0	Griffin Avin	FY 2022 HB1292 Funds
Utility Manager utility data collection	Subscription renewed	Renewal in process	$0	0	$20,000	0	Griffin Avin	FY 2022 HB1292 Funds
Evaluate CHW Thermal Storage at HSC CUP for load management	Evaluation made	In process	TBD	TBD	0	0	Griffin Avin	Part of Medical Education Building Project
Complete Engineering Evaluation for installing rooftop solar arrays at HSC (Warren Life, ECHI, and CUP)	Rooftop Solar Design Report	TBD	TBD	TBD	TBD	0	Griffin Avin / Chad Carwein	FY 2022 HB1292 Funds
Hire Energy Manager	Start in Fall 2022	TBD	N/A	N/A	N/A	1	Griffin Avin	Campus Operations Funds
Create Energy Analyst Position	Post job in Fall 2022	TBD	N/A	N/A	N/A	1	Griffin Avin	Campus Operations Funds

DEMAND

Strategies

- Continue to implement programs and initiatives, install equipment, and renovate buildings to make University buildings more efficient.

Tactics

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Steam trap replacements HSC	New traps installed	Complete	N/A	$7,152	$10,870	0	James Roberson	FY 2021 HB 1292 Funds
Steam Blanket Main Campus Boilers	Install Blankets	Complete	$39,463	$6,288	$120,000	0	Mike Deyoc	FY 2021 HB 1292 Funds
Retro Commission CCP1 and CCP2	Improved Operational Efficiency	Completed	$177,099	$59,033	$398,060	0	Ray Schmit	FY 2021 HB 1292 Funds
Install thermal window film SODM CSLC (3)	Film Installed	Completed	$1,972	$526	$30,000	0	Donald Crawford	FY 2021 HB 1292 Funds
Upgrade Building Automation System - Carol Belk	Improved Operational Efficiency	Completed	$25,000	$3,003	$166,825	0	Ray Schmit	FY 2021 HB 1292 Funds
Lighting performance Contract savings surplus	State M&V	Completed	NA	$132,361	NA	0	Griffin Avin	UNC System Lighting Performance Contract

DEMAND (Continued)

Strategies

- Continue to implement programs and initiatives, install equipment, and renovate buildings to make University buildings more efficient.

Tactics

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
VAV Controller Replacements - Rivers	Improved Operational efficiency	In Process	20,000	TBD	$147,600	0	Dan Durham	FY 2022 HB 1292 Funds
VAV Controller Replacements - Flanagan	Improved Operational efficiency	In Process	$25,000	TBD	$228,200	0	Dan Durham	FY 2022 HB 1292 Funds
Upgrades Controls from pneumatic to DDC - Brewster	Controls upgrades	In Process	$31,540	TBD	$446,300	0	Ray Schmit	FY 2021 HB1292 Funds
VAV Controller Replacements - Old Café	Improved Operational efficiency	In Process	$5,000	TBD	$68,200	0	Dan Durham	FY 2022 HB 1292 Funds
Retro Commission CCP3	Improved Operational Efficiency	In Process	$15,000	TBD	$78,800	0	Ray Schmit	FY 2022 HB 1292 Funds
ASHRAE Level II Audits of 5-10 buildings with high EUI relative to benchmarks	Final Reports	TBD	TBD	TBD	TBD	0	Griffin Avin	FY 2023 HB 1292 Funds
Conduct Pilot Project to create an In-House Building Retro Commissioning Program	Final Report	TBD	NA	TBD	0	0	Griffin Avin	FY 2023 HB 1292 Funds
Upgrade Lighting to LED - Leo Jenkins	Upgraded Lighting	TBD	N/A	TBD	TBD	0	Griffin Avin	FY 2023 HB 1292 Funds
Occupancy sensors and wireless thermostats for in-house installation	Purchase Devices	TBD	N/A	TBD	TBD	0	Griffin Avin	FY 2023 HB 1292 Funds

AWARENESS & TRAINING

Strategies

- Continue to focus efforts on developing and expanding resources of the ECU Sustainability Committee. Expand efforts to recognize and document efforts to reduce energy consumption and realize savings.

Tactics

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
University - Participate in the Appalachian Energy Summit	Attend Energy Summit	Energy Summit attended by faculty and staff in July 2019	N/A	N/A	$0	0	Chad Carwein / Griffin Avin	State Funds - HSC Sustainability
University - Participate in the Sustainability Alliance meeting	Attend Alliance Meeting	Participated in Alliance calls and annual meetings during the App Energy Summit	N/A	N/A	$0	0	Chad Carwein / Griff Avin	State Funds - HSC Sustainability
Attend AASHE Conference	Attend conference in October 2021	Attended virtually	N/A	N/A	$300	0	Chad Carwein	State Funds - HSC Sustainability
Hosted Campus Sustainability Day Fair	Hosted by ECU Sustainability Program and Student Clubs	Over 300 students, staff, faculty, and community members stopped by and learned about campus sustainability efforts	N/A	N/A	$500	0	Chad Carwein	State Funds - HSC Sustainability
Hosted 6th Sustainability Film and Discussion Series	Monthly screenings in fall 2021 and spring 2022	~ 40 attendees at each event on average	N/A	N/A	$800	0	Chad Carwein	State Funds - HSC Sustainability
Sustainability Manager gave guest lectures and group presentations	About 10-12 presentations per semester	Completed	N/A	N/A	$0	0	Chad Carwein	N/A
Hosted Earth Day Festival	Hosted by ECU Sustainability Program, Campus Departments, and Student Clubs	Over 500 students, staff, faculty, and community members stopped by and learned about campus sustainability efforts	N/A	N/A	$500	0	Chad Carwein	State Funds - HSC Sustainability
Update Construction Standards	Incorporate Energy and Water Efficiency Measures	Work in progress, long-term process	N/A	N/A	$0	0	Griffin Avin	N/A
Continued implementation of the ECU Sustainability Plan	Continued implementation	In process	N/A	N/A	$0	0	Chad Carwein	State Funds - HSC Sustainability
Complete Greenhouse Gas Emissions Inventory	Complete FY 2020-21 Report	Completed in Fall 2021	N/A	N/A	$400	0	Chad Carwein	N/A
Submit second AASHE STARS Report for ECU	Earn STARS Silver	STARS Silver earned in February 2020	N/A	N/A	$600	1 (intern)	Chad Carwein	State Funds - HSC Sustainability
Increase ECU presence on social media	Weekly activity on Facebook, Twitter & Instagram	Increased followers	N/A	N/A	$0	0	Chad Carwein	N/A

AWARENESS & TRAINING

Strategies

- Continue to focus efforts on developing and expanding resources of the ECU Sustainability Committee. Expand efforts to recognize and document efforts to reduce energy consumption and realize savings.

Tactics

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
University - Participate in the Appalachian Energy Summit	Attend Energy Summit in 2023	TBD	N/A	N/A	N/A	0	Griffin Avin	State Funds - HSC Sustainability
University - Participate in the Mid-Year Energy Summit	Attend mid-year meeting in 2023	TBD	N/A	N/A	N/A	0	Griffin Avin	State Funds - HSC Sustainability
Create Sustainability Outreach Specialist Position	Post job in Fall 2022	TBD	N/A	N/A	N/A	0	Griffin Avin	Campus Operations Funds
Attend Virtual AASHE Conference	Sustainability Manager and Chief Sustainability Officer will attend	TBD	N/A	N/A	$700	0	Chad Carwein/Griffin Avin	State Funds - HSC Sustainability
Host 7th Annual Sustainability Film and Discussion Series	Monthly screenings held virtually in fall 2020 and spring 2021	TBD	N/A	N/A	$1,200	0	Chad Carwein	State Funds - HSC Sustainability
Sustainability Manager gives guest lectures and group presentations	About 10-12 presentations per semester	TBD	N/A	N/A	N/A	0	Chad Carwein	N/A
Continue implementation of first ECU Sustainability Plan	Continue Implementation	TBD	N/A	N/A	N/A	0	Chad Carwein	State Funds - HSC Sustainability
Continue Green Office Program	Sign up 1-2 additional offices per semester	TBD	N/A	N/A	N/A	1 (intern)	Chad Carwein	State Funds - HSC Sustainability
Complete Greenhouse Gas Emissions Inventory	Complete FY 2019-20 Report in Fall 2020	TBD	N/A	N/A	$300	0	Chad Carwein	State Funds - HSC Sustainability
Establish a Building Air Barrier Standard for New Construction (blower door testing)	Posted to Construction Standards website	TBD	N/A	N/A	$0	0	Griffin Avin	NA

Water Management

Strategies

- Continue to implement programs, initiatives, and equipment that conserve water resources.

Tactics

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Upgrade existing irrigation zones to IQ "smart" system	Systems upgraded	Multiple systems upgraded	$5,000	$5,117	$30,000	0	John Gill	FY 2021 HB1292 Funds

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Complete feasibility study to assess ground water infiltration into Ross Hall basement and distribution tunnel to include reclaim and reuse of water	Complete Study	TBD	TBD	TBD	$30,000	0	Griffin Avin	Campus Operations Funds

DECLARATION

I have read the 2022-2023 Strategic Energy & Water Plan for East Carolina University. The plan, as presented, supports the reductions required in Senate Bill 668.

William E Bagnell 8/16/22

William E. Bagnell
Associate Vice Chancellor for Campus Operations

FAYETTEVILLE
STATE UNIVERSITY™

Strategic Energy & Water Plan

July 2022 – June 2023

Executive Summary

Fayetteville State University's **2022-23 Strategic Energy & Water Plan** is in direct support of several key documents.

- American College and University President's Climate Commitment Signatory (2010)
  FSU's Strategic Plan 2020-2025, Strategic Priority 5 – University Sustainability.
  - "Maximize the use of state and federal funds and diversify financial resources
  - Align fundraising efforts with strategic initiatives
  - Align technological investments with strategic priorities in collaboration with academic affairs
  - Build and upgrade physical infrastructure"
- American College and University President's Climate Commitment Signatory (2010)
- FSU's Sustainability Policy (2011)
- FSU's Climate Action Plan (2012)
- FSU's Climate Action Plan (2015)

The purpose of the **Strategic Energy & Water Plan** is to guide the fiscally and environmentally responsible usage of valuable resources per state legislation. Also, striving to educate and encourage students, staff, faculty, and visitors regarding the benefit of energy and water conservation while maintaining an comfort and appearance standards on the grounds and within the buildings on the FSU campus.

Key elements of this **2022-23 FSU Strategic Energy & Water Plan** include:

- Re-convene the FSU Sustainability Coalition and report progress and status on this Plan's goals and objectives
- Implement some form of a Building Manager Program at every one of FSU's facilities
- Incorporate sustainability principles in at least 1 course per semester in the 2022-23 academic year
- Continue working with campus departments on resource conservation, resulting in a reduction in FSU's carbon footprint and a more aware, engaged and educated campus community regarding conservation and sustainability at FSU.
- Identify key opportunities to simultaneously optimize space utilization and energy management goals
- Identify incentive programs from utility providers to reduce utility expenses

North Carolina Legislative Basis for the Plan

Session Law 2007-546 / Senate Bill 668 – Energy consumption per gross square foot to be reduced by 20% by 2010 and 30% by 2015 based on the 2003-2004 fiscal year. Each State institution of higher learning to update its management plan annually and include strategies for supporting consumption reduction requirements. Each university shall submit an annual Strategic Energy Plan to the State Energy Office.

Session Law 2008-203 / Senate Bill 1946 – Energy Efficiency: 30% reduction for new construction projects, 20% reduction for renovation projects (both based on 2004 codes). Water efficiency: for construction/renovation projects 20% reduction in indoor potable water use, and sum of outdoor potable water use and harvested storm water use will be reduced by 50% (based on 2006 NC Building Code). These requirements are mandatory for universities 8/8/2008.

NC Executive Order 156 – State Government Environmental Sustainability, Reduction of Solid Waste, and Procurement of Environmentally Preferable Products.

General Statute 143 64.12 – Utility Saving Initiative for State Agencies and State Institutions of Higher Learning.

UNC-GA Sustainability Policy – Adopted into the UNC Policy Manual on October 9, 2009. References both NC Senate Bills above, as well as portions of UNC Tomorrow.

Plan Goals and Objectives

1. **Increase institutional sustainability by efficiently managing campus resources**
   1.1. Educate faculty, students and staff about their roles and responsibilities in energy and water conservation
   1.2. Convene regularly and create interactive learning projects to champion culture change
   1.3. Coordinate with key external partners to improve FSU’s sustainability efforts

2. **Reduce campus energy and water consumption**
   2.1. Design and construct only LEED-Certified or equivalent, high-performing, energy and water efficient buildings
   2.2. Include building commissioning in all new construction and major renovation projects
   2.3. Implement energy and water conservation measures in campus facilities and operations

3. **Reduce utility expenses by working with utility providers on rates, incentives and other strategies**

   3.1. Ensure utility providers are applying appropriate rate schedules for accurate billing
   3.2. Identify and participate in all available utility incentive programs
   3.3. Sub-meter campus facilities to facilitate strategies to reduce utility expenses

Goal 1: 1. Increase institutional sustainability by efficiently managing campus resources					
Objective 1.1	Educate faculty, students and staff about their roles and responsibilities in energy and water conservation				
Objective 1.2	Convene regularly and create interactive learning projects to champion culture change				
Objective 1.3	Coordinate with key external partners to improve FSU's sustainability efforts				
2021-22 Activities	**Measurement** **Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
The Green Team / Integrate sustainability into co-curricular projects and events	Host educational/awareness events targeting campus users	Complete; multiple events held and successful	Staff time	S/EM Coordinator	FM operations
Integrate climate neutrality and sustainability into FSU academic curriculum and other educational experiences on campus	Incorporate sustainability into 1 or more classes each academic year	Complete; 1 or more classes held and successful in Spring 2022	Staff time	S/EM Coordinator, faculty	FM operations
Expand campus and external community outreach efforts	Involve students in community outreach via the service-learning program and Green Team events, and partnerships with local NGO partners like Sustainable Sandhills.	On-going	Staff time	S/EM Coordinator	FM operations
Prepare for the FSU GHG inventory for Second Nature in 2021-22	Begin data gathering effort	On-going	Staff time	S/EM Coordinator	FM operations
Implement energy and water conservation measures	Continue to implement measures to improve EUI reductions.	On-going. Key action is monitoring occupancy schedules	Staff time	S/EM Coordinator Support from MEP shop	FM operations
2022-23 Activities	**Measurement** **Expected**		**Investment**	**Assigned to**	**Funding Source**
The Green Team / Integrate sustainability into co-curricular projects and events	Host at least 4 educational/awareness projects/events targeting faculty, staff, and students		Staff time	S/EM Coordinator	FM
Integrate climate neutrality and sustainability into FSU academic curriculum and other educational experiences on campus	Incorporate sustainability into 1 or more classes each academic year		Staff time	S/EM Coordinator, faculty	FM operations
Expand campus and external community outreach efforts.	Convene a staff & faculty-led committee from multiple departments to advocate for sustainable development and practices on campus.		Staff time	S/EM Coordinator	FM operations
Improve waste management/recycling on campus.	Coordinate with Housing & Residence Life as well as the FM Environmental Services section to train and educate students, staff, and faculty to reduce waste and increase recycling rates.		Staff time	S/EM Coordinator	FM operations
Increase student engagement with FSU's sustainability program and the Green Team.	Recruit new students (freshmen AND transfers) onto the Green Team at orientations and other events.		Staff time	S/EM Coordinator	FM operations

Goal 2: Reduce campus energy and water consumption					
Objective 2.1	New construction and major building renovations standard to be LEED-certified or equivalent				
Objective 2.2	Include building commissioning in all new construction and major renovation projects				
Objective 2.3	Implement energy and water conservation measures in campus facilities and operations				
2021-22 Activities	**Measurement** **Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
Continue design and construction of LEED certified or equivalent, high-performance buildings	Lyons Science comprehensive renovation project and any other buildings.	High performance elements were incorporated to meet LEED standards.	Design effort; construction cost	Facilities Management, Planning & Construction	State, Title III, other federal funding sources
Include building commissioning on all new construction and major renovation projects	Lyons Science comprehensive renovation project and any other buildings.	Done: building Cx is included.		Facilities Management, Planning & Construction	State, Title III, other federal funding sources
Apply for HB1292 Energy Savings carry forward funds	Certify eligible savings and confirm surplus in utility budget for carry forward funds to invest in energy saving projects.	Done for FY21 and FY22	Staff time	S/EM Coordinator	FM operations
2022-23 Activities	**Measurement** **Expected**		**Investment**	**Assigned to**	**Funding Source**
Incorporate energy use into campus space planning and utilization efforts	Identify key opportunities to simultaneously optimize space utilization and energy management goals.		Staff time	S/EM Coordinator	FM operations
Apply for HB1292 Carry-Over funds	Certify eligible savings and confirm surplus in utility budget for carry forward funds to invest in energy saving projects.		Staff time	S/EM Coordinator	FM operations
Investigate opportunities to incorporate renewable energy into campus energy portfolio.	Continue work with PWC for roof-mounted and ground mounted solar arrays combined with energy storage.		Staff time	S/EM Coordinator	FM operations
Implement energy and water conservation measures.	Implement at least 4 new ECM/WCM's on campus this FY. HB1292 Energy CF funds can be utilized.		Staff time, ECM WCM cost	S/EM Coordinator	FM operations, HB1292 funds

Goal 3: Reduce utility expenses by working with utility providers on rates, incentives and other strategies					
Objective 3.1	Ensure appropriate utility rate schedules and accurate billing				
Objective 3.2	Identify and participate in all available utility incentive programs				
Objective 3.3	Sub-meter campus facilities to inform strategies to reduce utility expenses				

2021-22 Activities	**Measurement Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
Review all utility accounts to ensure appropriate rate schedule and accurate billing	Complete annual account review for all electric, natural gas, and water & sewer accounts	Done, on-going	Staff time	S/EM Coordinator	FM operations
Work with utility providers to identify incentive programs to reduce FSU utility expense	Document responses and pursue opportunities with all providers	Done, on-going	Staff time	S/EM Coordinator	FM operations
Work with FM Superintendent – Trades to avoid Peak Hours during Winter and Summer time	Monthly reminder and recommend energy saving opportunities to the team	Done, on-going	Staff time	S/EM Coordinator	FM operations
Continue subscription to the PWC Community Solar program.	Receive credits and reduces expenses on the FSU monthly bill	Done, on-going	Monthly subscription	S/EM Coordinator	FM operations
Establish electric car charging stations on campus.	Make grant application to fund a project.	Done, on-going	Staff time	S/EM Coordinator	FM operations
Include sub-metering on all new construction and major renovation projects	Install natural gas metering on at least 4 large state-funded buildings	Incomplete	n/a	S/EM Coordinator	FM operations
	Implement a web-based real-time energy and sustainability dashboard application	Incomplete	n/a		

2022-23 Activities	**Measurement Expected**	**Investment**	**Assigned to**	**Funding Source**
Review all utility accounts to ensure appropriate rate schedule and accurate billing	Input monthly account invoice for all electric, natural gas, propane, and water/sewer accounts in database	Staff time	S/EM Coordinator	FM operations
Work with utility providers to identify incentive programs to reduce FSU utility expense	Document responses and pursue opportunities with all providers	Staff time	S/EM Coordinator	FM operations
Work with campus leadership to expand setpoints during winter and summer to reduce peak electrical demand and usage.	Propose the setpoint at 75 degrees for summer and 68 degrees for winter during the peak hours	Staff time	S/EM Coordinator	FM operations
Establish electric car charging stations on campus.	Apply for grants; incorporate into new building and parking lot renovation projects.	Staff Time	S/EM Coordinator	FM operations
Identify funding opportunities renewable energy projects	Continue the search for a viable financed energy project	Staff time	S/EM Coordinator	FM operations

Declaration

I have read the FSU 2022-23 Strategic Energy & Water Plan. The plan, as presented, supports reductions required in G.S.143-64.12a (minimum 40% reduction in annual energy/water consumption by 2017).

Signed this 12th day of October, 2022.

Commitment

- Energy and water management is the responsibility of the occupants at each facility, guided and supported by the FSU Energy and Sustainability Coordinator and FSU Facilities Management and Operations staff.
- The attached plan outlines the activities and expenditures required to reach energy and water consumption reduction goals.
- FSU Department Heads will review progress and results quarterly and will support the FSU Energy Sustainability Coordinator's attendance at Departmental meetings as required.

Strategic Energy & Water Plan Mandate - Goal

Reduce annual Total Energy Consumption by a minimum of 40% by fiscal year 2016-2017 from a baseline fiscal year of 2002-2003.

Strategic Energy & Water Plan Mandate - Measure

Our Key Performance Indicator is *Total Energy Use in BTU per Square Foot per Year.*

Strategic Energy & Water Plan Mandate - Commitment

I have read and support the FSU 2022-23 Strategic Energy & Water Plan.

Tai Davis
Tai Davis (Oct 12, 2022 18:15 EDT)

Tai Davis
Director of Facilities Operations & Maintenance

Gene Cottrell
Gene Cottrell (Oct 12, 2022 18:03 EDT)

Gene Cottrell
Director of Facilities Administration & Budget

Jon Parsons
Associate Vice Chancellor, Facilities Management

Gregory Lovins (Oct 12, 2022 18:50 EDT)

Greg Lovins
Interim Vice Chancellor, Business & Finance

FSU 2022-23 Strategic Energy Plan

Final Audit Report 2022-10-12

Created:	2022-10-12
By:	Jon Parsons (jparson2@uncfsu.edu)
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Agreement completed.

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August 15, 2022

Ms. Julie Pfeiffer
NC Department of Environmental Quality
217 West Jones St.
Raleigh, NC 27699

Subject: Strategic Energy Plan – NCSSM

Dear Mr. Conway:

Attached is a copy of the 2022 Annual Utility Consumption Report and the 2022 Strategic Energy Plan of the North Carolina School of Science and Mathematics.

Thank you for your outstanding support and advice to help NCSSM on energy awareness and conservation. As a small institution, your efforts have made it a successful project.

If you have any questions or comments, please contact me at (919) 416-2667 or covington@ncssm.edu.

Sincerely,

Garry D. Covington

Garry Covington
Director of Plant Facilities

Attachment

c: Dr. Todd Roberts – w/Attachment
Mr. Robert Allen – w/Attachment
Mr. Bruce Chisholm – w/Attachment
Mr. Michael Mitchell III – w/Attachment
Ms. Miriam Tripp – w/Attachment

North Carolina School of Science and Mathematics

Strategic Energy Plan

August 15, 2022

Table of Contents

Executive Summary

NCSSM Background

The North Carolina School of Science and Mathematics (NCSSM) opened in 1980 on the site of the former Watts Hospital in Durham, NC. Most of the buildings on campus were built between 1909 and 1953, which is the major cause of many of the energy-related problems, and regular maintenance and repair issues. NCSSM's campus is on the National Register of Historic Places because of the Watts Hospital.

NCSSM is the first residential public high school in the country for juniors and seniors with an interest in science and mathematics. NCSSM is a constituent high school member of the UNC System, and is a public high school. It does not charge tuition or student fees for students to attend the school. The legislation creating NCSSM was strongly advocated by Governor Hunt, and it was approved in 1978 with the Speaker of the House of Representatives casting the deciding vote since the NC House was evenly divided about NCSSM.

Since its fledgling start, NCSSM has continued to be under funded and neglected since it opened in 1980. NCSSM continues to direct its limited funding to the academic and student residential program. However, NCSSM's physical plant infrastructure needs a significant infusion of additional funds to keep the plant facilities in operation. One explanation for the under-funding of NCSSM is that there was significant doubt whether or not NCSSM would survive ten years. It should be noted that Durham County donated the Watts Hospital to the State of North Carolina with the provision that if the school closed within 12 years, the facility would be returned to Durham County.

There are over 350 other public high schools in North Carolina, but NCSSM is the only high school that has been required to absorb the various State of North Carolina budget reductions just like state agencies and the University of North Carolina institutions. In the past NCSSM has often been required to absorb these cuts even though it has no student fees or tuition, or local funds to support it like the other public high schools or UNC System institutions.

Scorecard Results

Considering the impact of a growth of 28% student equivalents, 39% staff, and 22,323 (5.0%) square feet, NCSSM reduced its annual Total Energy Consumption since the base year of 2002-03. **Comparing energy consumption per staff-student equivalent in 2021-2022 with the baseline year of 2002-2003, electricity usage decreased 35.5%, natural gas usage decreased 30.5%, and water usage decreased 48.7%. Total energy consumption per student equivalent decreased by 32.4% from the baseline year.** In 2021 – 2022, there were 423 online, 412 distant learning students, and 60 workshop students. The on-line students stay on campus during extended weekends. The student equivalents are calculated using conservative estimates of 5% of a full-time residential student for on-line students, 20% for workshop students, and 1% for distance learning students. The student-staff equivalents are calculated as: number of staff, plus number of student equivalents.

Baseline Utility Use

The energy use mix of the North Carolina School of Science and Mathematics is approximately 48% electricity, 36% natural gas, 16% water and sewer, and 0% fuel oil. Comparing 2021-22 with the previously year, natural gas usage increased 0.8%, electricity usage increased 5%, and water usage increased 19%.

NCSSM's Annual Utility Report is included in the Appendix. It identifies the usage and cost information for each type of energy source at NCSSM. As noted in the Scoreboard Results, NCSSM increased its annual Total Energy Consumption in 2021-22 compared to the base year of 2002-03, due to the increase in the number of students, staff, workshops, and online students coming to campus. However, **comparing the total staff-student equivalents in 2022 with 2003, total energy consumption (BTU) per staff-student equivalent decreased by 32.4%, and water usage per student equivalent decreased by 48.7%**

Key Actions

The following actions have helped NCSSM reduce its overall net energy usage:

- Monitor natural gas usage
- Plan to Continue Utility Accounting
- Energy Management Awareness
- Conservation Awareness Team
- State Energy Office Recommendations
- HVAC – Chiller Repairs and Renovations
- Lighting Performance Contract
- Steam Leak Repairs
- Guaranteed Energy Saving Performance Contract
- Replacing Air Handler Units and Controls

Savings Estimate & Financial Evaluation

A detailed review of the financial evaluation of the energy usage is included in Section 1 of the Strategic Energy Plan. NCSSM is continuing to develop and implement an energy conservation program. It is continuing to explore various energy management projects such as performance contracts. NCSSM has upgraded the lighting throughout the campus to LED through the system wide performance contract. NCSSM has recently completed a guaranteed energy savings performance contract. This contract includes water savings areators and flush valves, LED parking lot and gymnasium lightings and HVAC controls. The reduction in usage (per staff-student equivalent) of 35.5% in electricity, 30.5% in natural gas, and 48.7% in water, resulted in a $371,512 cost avoidance. Because of COVID, it is difficult to compare 2021 -22 to previous years. The students were sent home in March 2020 for the remainder of the 2019-2020 school year.

For the entire 2020-2021 school year, the residence halls operated at half capacity. This contributed to some of the utility savings for that year. The school returned to 100% capacity for the 2021-2022 school year. During COVID, all air filters were changed to MERV 13 filters. This change added to the heating/cooling loads due to the air handlers having to work harder to overcome the added filtration. Additionally, natural gas usage for 2021-2022 increased 0.8% over 2020-2021 while the cost of natural increased by 53% for the same period.

Goals and Measures

NCSSM has an overall goal to reduce the annual Total Energy Consumption. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM's students, additional buildings on campus, and added staff members.

1. Baseline Energy Use

Based on NCSSM's growth of 28% in student equivalents, 39% in staff, 5.0% in square feet, total energy consumption has decreased since the baseline year of 2002-03 by 32.4%. Other items affecting NCSSM's energy consumption is the addition of two emergency (natural gas) generators for student safety, students remaining on campus during the summer months for research, additional summer workshops with more residential participants, running one boiler during the summer months to maintain reheat and reduce mold, and online students residing on campus during extended weekends.

NCSSM Energy Consumption

	2021-22	**2002-2003**	**Increase/Decrease**	**Percentage**	**Increase/Decrease per Staff-Student Equivalent**
Electricity Use (kwh)	7,231,372	7,774,573	-543,201	-7.0%	-35.5%
Natural Gas Use (therms)	441,320	440,442	+878	+0.2%	-30.5%
Water Use (1,000 Gal.)	12,362	16,714	-6,337	-26.0%	-48.7%

As indicated in the table above, **electricity usage decreased by 35.5%, natural gas consumption decreased by 30.5%, and water usage decreased by 48.7% (based on staff-student equivalent) from the baseline year 2002 – 2003.**

The budget reductions during the past several years have made it difficult to compare the usage and expenditure information between years. The Office of State Budget and

Management's required reversions forced NCSSM to carry over June 2003 expenditures to be paid in July 2003. The carry over caused the expenditures to be understated in 2002-03 and overstated in 2003-04. The energy consumption information above and in the Appendix has been restated to show the actual June 2003 expenditures and usage in 2002-03 and 2003-04. The adjustment shows the expenditures and usage in the year in which the consumption actually occurred.

The energy use mix of the North Carolina School of Science and Mathematics is approximately 48% electricity, 36% natural gas, 16% water and sewer, and 0% fuel oil. The natural gas is used to provide heat for the campus buildings, the 680 residential high school students from throughout North Carolina, 423 online students, and 347 staff (permanent and temporary) positions. Natural gas is also used to provide hot water and emergency power to the campus.

2. Planned Actions & Projects

2.1 Plan to Continue Utility Accounting

During 2022-23 NCSSM will continue to maintain the Utility Accounting process to track the cost and usage of electricity, water, natural gas, and fuel oil. The Utility Accounting database will follow the guidelines of the State Energy Office, and it will remain in an electronic spreadsheet format. The data will be used to prepare the Annual Utility Cost and Usage Summary Report in August 2023 to the State Energy Office.

2.2 Energy Management Awareness

NCSSM will use various methods to make the NCSSM community (students and staff) aware of the impact of energy management, and the importance of reducing the energy consumption at NCSSM.

- The Sustainability Awareness Group will hang signs/posters in key locations encouraging people to conserve energy and water.
- Include energy management messages in the "Daily Unicorn," which is a daily publication of current events on campus.
- Provide electronic updates about energy management to all students and staff through the Sustainability Awareness Group.
- Include Energy Management as an All School Day Session at NCSSM / for all students and staff.

2.3 Conservation Awareness Team

The NCSSM Conservation Awareness Team will promote conservation education and behavioral changes for all facility users. Since NCSSM is a residential public high school for juniors and seniors, it is a continuing process since there is a 50% turnover in the student body each year. The team includes the following NCSSM staff and students:

Name	Position
Robert Allen	Vice Chancellor for Finance and Operations
Garry Covington	Director of Plant Facilities
Bruce Chisholm	Assistant Director of Plant Facilities
Dr. Katie O'Conner	Vice Chancellor for Academic Programs (Leader of Sustainability Group)
Michael Mitchell	Utility Manager (Electrician)
Todd Bollinger	Grounds Supervisor (Sustainability Advisory Group)
Jon Davis	NCSSM Faculty (Sustainability Advisory Group)
NCSSM Students	Student Sustainability Advisory Group

See Section 5, Goals and Measures, for a listing of goals for the Conservation Awareness Team.

2.4 Long-Term Water Efficiency Plan – NCSSM
NCSSM developed a Long-Term Water Efficiency Plan in 2004 to reduce water usage.

2.5 State Energy Office Recommendations
NCSSM will implement any proposed rate change recommendations from the State Energy Office after the recommendations are provided.

2.6 HVAC - Chiller Repairs and Renovations Project
The HVAC - Chiller repairs and renovations project to add a new chiller was completed in 2007 and provided more efficient HVAC services since an inefficient 20+ year old chiller was replaced. An investigation was completed during 2004-05 that recommended building a closed loop chilled water system at NCSSM, which will provide cooling to all parts of the campus even if one chiller is not working. The closed loop portion of the project was completed in fall of 2008.

2.7 Steam Leak Repair
Numerous underground steam leaks were repaired in June 2013 and reflected a reduction in gas and water usage for 2014.

2.8 Performance Contract – Lighting Upgrades
The lighting upgrade performance contract was completed in 2016. This project replaced existing lighting with energy efficient LED lighting.

2.9 Guaranteed Energy Savings Performance Contract. During 2017 – 2018, NCSSM negotiated a performance contract. This project was completed in early 2019-20. This project includes water savings opportunities, LED lighting for gymnasium and parking lots, new cooling tower, and HVAC controls. This performance contract is projected to have an energy savings of $4,500,000 over the first 15 years

3. Savings Opportunity Assessment

The combination of the planned actions and projects, and activities in Sections 2 and 3 will help NCSSM achieve its goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 28% student equivalents, 39% staff, and 5.0% square feet since the base year of 2002-03.

3.1 FCAP Operation and Maintenance Energy Survey Recommendations

NCSSM is continuing to implement the recommendations of the Operations and Maintenance Energy Survey. The recommendations included HVAC and Lighting-related issues.

1. Modify Thermostat Settings. In response to the survey recommendations, NCSSM adjusted the thermostat settings and reset the thermostats at the beginning of each year when the students return for the school year.

2. Deduct Sewer Costs for Cooling Tower Make-Up Water. Included in the guaranteed energy savings performance contract was to install metering that will allow the school to deduct the sewer cost for water make up to the cooling towers for the main and Hunt chillers.

3. Turn Off Lights in Unoccupied Rooms. NCSSM will continue its efforts to have the lights turned off in unoccupied rooms. Occupancy sensors for classrooms and conference rooms are included in the system-wide lighting performance contract.

4. Convert Incandescent Lighting to Compact Fluorescent. NCSSM will continue to install compact fluorescent lights as funds permit. **Complete**: Incandescent lighting has been replaced with compact fluorescent or LED lighting throughout the campus.

5. Replace Royall Heat Recovery Wheel. This will use the building exhaust air to condition the fresh air intake before sending it to the coils. **Complete**

6. Reduce Boiler Operating Pressures. Reduce the operating pressures of the boilers to reduce the natural gas usage. - **Complete**

4. Financial Assessment

NCSSM has delayed using its Repairs and Renovations projects to fund energy-related conservation projects since the primary focus has been on student safety for Electronic Access Upgrades Phase I and Phase II, and Sprinklers in Residence Halls Phase I and Phase II. See Section 6, Budgets, for a listing of various current and planned projects. NCSSM is considering the Performance Contracting as an additional option to fund energy-related projects. As a small under-funded educational institution, NCSSM does not have reserves to pay for unforeseen utility or other maintenance and repair projects. The UNC System lighting performance contract was an excellent approach that met NCSSM's needs. The school completed a guaranteed energy savings performance contract in early 2019-2020. This contract is projected to have an energy savings of $4,500,000 over the first 15 years.is also negotiating a performance contract.

5. Goals and Measures

NCSSM has an overall goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 28% student equivalents, 39% staff, and 5.0% square feet since the base year of 2002-03. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM's students, additional square feet of new plant facilities, and added staff members.

5.1 Key Performance Indicators (KPI)

The tracking measures will be used to develop and compare the results for the following State Key Performance Indicators (KPI):

- Total Utilities Cost per Square Foot
- Total Utilities Cost per Student Equivalent
- Electric KWH Use per Square Foot
- Electric KWH Use per Staff-Student Equivalent
- Total Gallons Water per Square Foot
- Total Gallons Water per Staff-Student Equivalent
- Gas Btu Use per Square Foot
- Gas Btu Use per Staff-Student Equivalent

It is critical to note that due to the recent budget shortfall situations, NCSSM was forced to carryover its electrical utility costs for June 2003 into 2003-04 to be paid. The forced reversion continued to cause significant hardships to NCSSM and has made it difficult to compare annual energy costs between years.

5.2 Conservation Awareness Team

NCSSM has established the goals and specific items listed below for the Conservation Awareness Team to encourage acceptance from the NCSSM community. Since NCSSM's 680 students are high school juniors and seniors in a residential program, it will include specific difficulties in getting teenagers to accept and follow utility savings measures. It is difficult enough for families to get teenagers in their home to make utility conservation measures, much less when the students are in a residential setting of 680 students.

1. Students and staff will be encouraged to turn off lights and equipment, other than computers, when leaving a room.
2. Turn off all lights and unnecessary equipment at the end of the day.
3. Monitor management software has been installed on NCSSM's computers by the Information Technology Services Department.
4. Vending machines were de-lamped in the Fall 2002 to reduce utility usage of vending machines.
5. Incandescent and compact fluorescent lighting have been replaced with energy efficient LED lights throughout the campus. This was done through the system-wide lighting performance contract.
6. The Guaranteed Energy Savings Performance Contract was completed in early 2019 – 2020. This project replaced parking lot lights and gymnasium lighting with LED as well as replacing HVAC controls. It is projected to have an energy savings of $4,500,000 over the first 15 years.

5.3 Sustainability Advisory Group

During 2012, NCSSM formed a Sustainability Advisory Group. This group consists of NCSSM administrators, faculty, staff, and students. The main functions of this group are:

1. Create awareness
2. Coordinate sustainability-related activities on campus
3. Develop measures for success
4. Determine measures to disseminate NCSSM's progress

The student led groups, Accept the Greener Challenge (AGC) and Sustainability Project Leaders (SPL) are a part of the group. Some of the activities include

- Publicity and educational awareness
- Construction of a rain garden
- Develop goals for composting and recycling
- Sustainability Cup – energy conservation contest between residence halls
- Greener Unitiative Challenge – year long competition in 3 categories (research, awareness, and outreach)

6. Budget

NCSSM has completed its two projects funded by the Higher Education Bond Program. Both the Royall Center (fully operational in 2003-04) and the Bryan Center (completed in July 27, 2004) included energy conservation design features in the $5.2 million projects. The projects resulted in a more effective use of energy since the Bryan Center converted the Physics area to the central HVAC system for cooling. Previously, the areas had either window air conditioning units or no air conditioning for the Physics Department. It was the only academic area on NCSSM's campus that had not been renovated since NCSSM opened in 1980. Project effort in 2009-10 was student safety; therefore, less spending was on utility projects than in previous years.

2011 – 2012 R&R funds, which were received in December 2012, allocated funds to repair underground steam leaks. Some of the small underground leaks were located and repaired in December 2012. The major leaks were located and repaired in June 2013. The repairs of these steam leaks resulted in a savings in natural gas for 2013- 2014.

2013 – 2014 R&R funds allocated funds for the construction of the new Fab Lab which is equipped with new energy efficient HVAC units. Funds were also allocated to maintain equipment and infrastructure, tune the main boilers, and clean chiller evaporator tubes which help provide for more energy efficient operation.

2014 – 2015 R&R funds allocated funds for the renovation of Engineering and Robotics which improved the controls for the HVAC units. Funds were also allocated to maintain equipment which will provide for more energy efficient operation.

2015 2016 The system-wide lighting performance contract was completed. This contract replaced incandescent and compact fluorescent lighting with energy efficient LED lighting.

2016 – 2017 Grant funds were obtained to install solar panels at the sustainability garden. These efforts will help reduce energy usage.

2018 – 2019 Construction will begin on the guaranteed energy savings performance contract. This project is expected to save $4,500,000 during the life of the loan.

2019 – 2020 The guaranteed energy savings performance contract was completed in early 2019-2020 and the school has begun receiving the savings. Energy saving features will be incorporated in the design and construction of the NCSSM Western Campus.

2020 – 2021 Five fan coil units were replaced with new, more efficient units, as well as energy efficient controls. Steam leaks were also repaired providing additional savings.

2021 – 2022 Two fan coil units were replaced with new, more efficient units as well as energy efficient controls.

7. Planned Future Projects

Energy related projects (if funded) that are included in our Capital and R&R Six Year Plan are as follows:

2022 – 2023 Chiller Replacement at an estimated cost of $3,000,000
2022 – 2023 Replace additional AHU & Controls at an estimated cost of $450,000
2023 – 2024 Boiler Replacement at an estimated cost of $350,000
2023 – 2024 Window Replacement at an estimated cost of $3,000,000

North Carolina State University (NCSU) Energy Management

2023 Strategic Energy Management Report

Date: 27 October 2022

Highlights and Accomplishments

The following are highlights and accomplishments of energy efficiency strategies implemented during fiscal year 2022:

- NC State successfully funded more than $1,332,000 of campus energy projects that resulted in projected annual savings of $945,000. Multiple projects ranging from whole building lighting upgrades to building controls upgrades were completed through cost-sharing programs with campus partners.

- Through collaboration among business units within the Facilities Division, Energy Management compiled the fiscal year (FY) 2022 Reinvestment Act claim for more than $3 million in energy savings. The Reinvestment Act of 2010, also known as NC House Bill 1292, allows NC institutions to capture a portion of energy and water savings for reinvestment in further conservation projects.

- The in-house Commissioning Team's work continues to improve the efficiency of NC State buildings through mechanical equipment calibrations, sequence adjustments and HVAC schedule implementations. Partnering with Building Maintenance and Operations technicians, the team achieved $2.5 million in savings in fiscal year (FY) 2022.

- NC State's Energy Performance Contracts span 3 utility plants and 14 buildings across campus. Upgrades range from CHP ("CoGeneration") to HVAC systems upgrades. Each project has a guaranteed annual energy savings; when combined, these projects help NC State avoid at least $10.5 million in utility costs per year.

- Annually, NC State shuts down for the Winter Holiday so the Energy Management and Facilities groups take advantage of this shutdown by incorporating a Holiday Energy Savings Initiative (HESI). Through this initiative, building temperature setpoints are lowered, unnecessary lights and equipment are turned off, and doors and windows are closed throughout campus in an effort to reduce utility consumption. During the FY22 HESI, $416,000 in energy costs were avoided, and since inception in 2005, the HESI program has accounted for over $5,200,000 in energy cost avoidance.

- Funding has been identified for the second phase of the Exterior Lighting LED Conversion project which converts existing pole-mounted lights to LED. This project increases energy efficiency and also enhances nighttime safety. The first phase converted nearly 1,200 existing pole-mounted lights to LED, while also installing over 150 new pole-mounted lights. With the first phase completed, NC State’s pole-mounted exterior lighting is over 50% LED, and the overall project aims to save over $100,000 annually in electricity costs with the more efficient LED lights. The second phase will continue these efforts by targeting over 300 lights on South campus along with over 1100 lights on Centennial campus.

Key Performance Indicators

NC State tracks year-over-year change as well as change vs. baseline years. Overall performance vs. baseline shows a 35% decrease in Energy Use Intensity (EUI), and a 59% reduction in total water use on campus despite a 55% growth in campus gross square footage.

In FY22, students, faculty, and staff were back on campus with energy intensive Covid mitigation strategies in use. These strategies include increased outside air, longer HVAC operating hours, and higher levels of air filtration. The result was a higher EUI as compared to the Covid years of FY20 and FY21, but an overall slight reduction in EUI when compared to pre-covid 34% EUI reduction.

Table 1 - KPI Summary 2022

Fiscal Year	2001-2002 *	2002-2003	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	% Change (1 Year, vs FY21)	% Change (vs Pre-Covid FY19)	% Change from Baseline
Utility Cost, $ / GSF		$1.98	$1.85	$1.84	$1.60	$1.51	$1.93	28%	5%	-3%
Energy Cost, $ / GSF		$1.87	$1.58	$1.56	$1.34	$1.30	$1.70	31%	9%	-9%
Water Cost, $ / GSF	$0.12	$0.11	$0.27	$0.28	$0.26	$0.21	$0.24	14%	-14%	102%
Energy Consumption, BTU / GSF		171,810	119,144	113,859	108,737	108,079	111,602	3%	-2%	-35%
Potable Water Consumption , CCF / GSF	0.066	0.054	0.031	0.033	0.030	0.024	0.027	13%	-18%	-59%
Total Water Consumption , CCF / GSF	0.066	0.054	0.035	0.037	0.035	0.029	0.033	12%	-12%	-51%
Campus Area, Gross Square Feet (GSF)	9,796,638	9,910,619	14,972,547	14,963,604	14,999,125	15,133,063	15,316,354	1.2%	2.4%	55%
Heating Degree Days		3,592	3,374	3,151	2,744	3,136	2,697	-14.0%	-14.4%	-25%
Cooling Degree Days		1,656	2,034	2,052	1,942	1,820	2,013	10.6%	-1.9%	22%

* Baseline year for water cost and consumption per gsf is 2001-2002 as defined in Gov. Easley's Executive Order Number 26. For other KPIs, baseline year is 2002-2003.

Table 1 - Key Performance Indicator Summary from 2021-2022

Commitment

NC State University has committed to the following **energy management goals:**

1. By 2025, reduce total campus energy use intensity (EUI) by 40% from the Fiscal Year 2003 baseline.
2. Expand the amount of renewable energy used to meet NC State's needs.
3. Reduce campus water consumption by 65% from the Fiscal Year 2002 baseline.
4. Contribute to NC State's total greenhouse gas (GHG) emissions reduction goal by 25% from the 2008 baseline.
5. Collaborate to inform and to empower the campus community for energy and water savings.

Energy Management Strategies *(And the Goals to which they apply)*

Strategy A: Optimize building energy use through energy auditing, retro-commissioning, predictive maintenance, control upgrades, incentive programs and occupant education. *(Goals 1, 3, 4, and 5)*

- Tactic A1: Use Building Energy Assessment Tool (BEAT) to compare building performance based on industry building energy standards.
    - Continuous: BEAT update cycle began in August 2021.
- Tactic A2: Require building envelope commissioning for new capital projects.

- Some Progress: Design Guidelines for building envelope commissioning are under development. The Plant Sciences Building completed in 2022 was the first building that required envelope commissioning prior to building acceptance.

- Tactic A3: Upgrade obsolete building controls as necessary.
  - Some Progress: Several buildings across campus were upgraded in FY2022. Additional building control upgrades are planned for FY 2023.
- Tactic A4: Promote the Ultra-Low Temperature Freezer Rebate Program to replace inefficient freezers with energy efficient ones.
  - Continuous: In FY 2022, 10 freezers were replaced with high efficiency models.

Strategy B: Reduce energy use in NC State's five central utility plants by 5% from 2015 baseline. (Goals 1, 3, and 4)

- Tactic B1: Install variable frequency drives (VFDs) on utility plant pumps.
  - Some Progress: VFDs were installed on two chilled water and one condenser water pumps at Cates and Yarbrough Utility Plants in FY 2022.
- Tactic B2: Recommission the utility plants and optimize the system curves.
  - Some Progress: Efforts are ongoing to improve the controls and sequence of operation of the chilled water and condenser system water loops at the Veterinary school utility plant. Also, plan is ongoing to develop a scope for the installation of nozzle cups for maximum water distribution within the cooling towers. Similar efforts and model at the vet plant would be used across all other utility plants on Campus.
- Tactic B3: Conduct steam trap surveys to identify failed traps for replacement.
  - Continuous: Annual steam trap survey and repair in utility plants and distribution tunnels.
- Tactic B4: Conduct boiler tune-ups.
  - Continuous: Tune-ups are performed annually on all utility plant boilers to ensure optimal operation.

Strategy C: Explore and develop best practices for smart infrastructure and energy generation use in campus buildings. *(Goals 1, 2, 3, 4, and 5)*

- Tactic C1: Construction of solar and battery energy storage systems for multiple campuses.
  - In Progress: Efforts are ongoing to materialize the solar PV system at Fitts-Wollard Hall which is in the construction phase. Also, the Battery Energy Storage System (BESS) at Partners I is under review by the State Construction Office (SCO) and awaiting authority to bid. The completion of both projects is expected for FY23.
- Tactic C2: Incorporate chilled water Thermal Energy Storage (TES) at the Centennial Campus Utility Plant
  - Complete: TES tank is operational.

Strategy D: Reduce potable water consumption across all campuses. *(Goals 3 and 4).*

- Tactic D1: Employ reuse (reclaimed or non-potable) water for toilets, irrigation, etc. on Centennial Campus
  - Some progress: Fitts-Woolard Hall and the new Plant Sciences Building uses reuse water for irrigation and domestic sanitation.
  - Complete: Centennial Campus Utility Plant uses reuse water for cooling tower make-up.
- Tactic D2: Reduce potable water use in campus buildings and utility plants. Assess novel and proven technologies to guide efforts.
  - Complete: Jordan Hall cooling tower replacement to reduce the amount of water loss due to tower degradation.
  - In progress: Project is underway to reroute water previously sent to the drain for use as boiler makeup water.
  - On Hold: Partnership with NC State Stewards to equip student volunteers with tools to test bathroom faucet flow rates and replace with low flow faucet aerators as needed in academic buildings. The COVID-19 pandemic put this on hold and is expected to resume in FY 2022.

Energy Management Team

Name	Role
Allen Boyette	Senior Director - Energy Systems
Damian Lallathin	Director of Energy Management
Zack Wenning	Energy Data Systems Administrator
Lib Reid McGowan	Energy Data Analyst
Alex Freeman	Energy Project Manager
Raheem Ariwoola	Energy Project Engineer
Julie Snead	Energy Project Engineer

Costs of Analysis

NC State collects electric usage data from 100% of its buildings and thermal utility usage data from approximately 80% of its buildings. NC State has developed a tool to calculate building EUI and compare that performance to ASHRAE 100-2015 EUI benchmarks. The resulting output is weighted based on annual cost of operation to identify targets for investigation and remediation.

Internal costs are attributed to analysis and investigation performed by campus energy engineers. This upcoming year, in addition to the recommissioning efforts, we plan to expand the in-house energy auditing program. In some occasions, analysis is outsourced to specialist consulting groups and these projects along with estimated costs are depicted in the table below. Currently funded studies are shown in the table below.

Fiscal Year	Projects	Cost	Results
2022-2023	Schaub	$43,500	Phase I Level I completed. Phase II Level II Ventilation Demand Assessments and VAV conversion to manage the airflow for laboratory safety and energy conservation.
2022-2023	Fox	$40,000	Phase I completed. Phase II Ventilation Demand Assessments to manage the airflow for laboratory safety and energy conservation.
2022-2023	Thompson & Partners III	$100,000	Comprehensive Energy Audits to develop energy conservation measures, optimize efficiency and minimize utility costs.

Appendix A: Performance

Energy

Campus energy consumption peaked in fiscal year 2009 and has trended downward since. A combination of unusually mild weather and uneven fuel oil purchases contributed to the apparent uptick in fiscal years 2017 and 2018. Compared to the fiscal year 2003 baseline, total energy consumption per gross square foot (GSF) has decreased by 35% in fiscal year 2021 (see Figure 1).

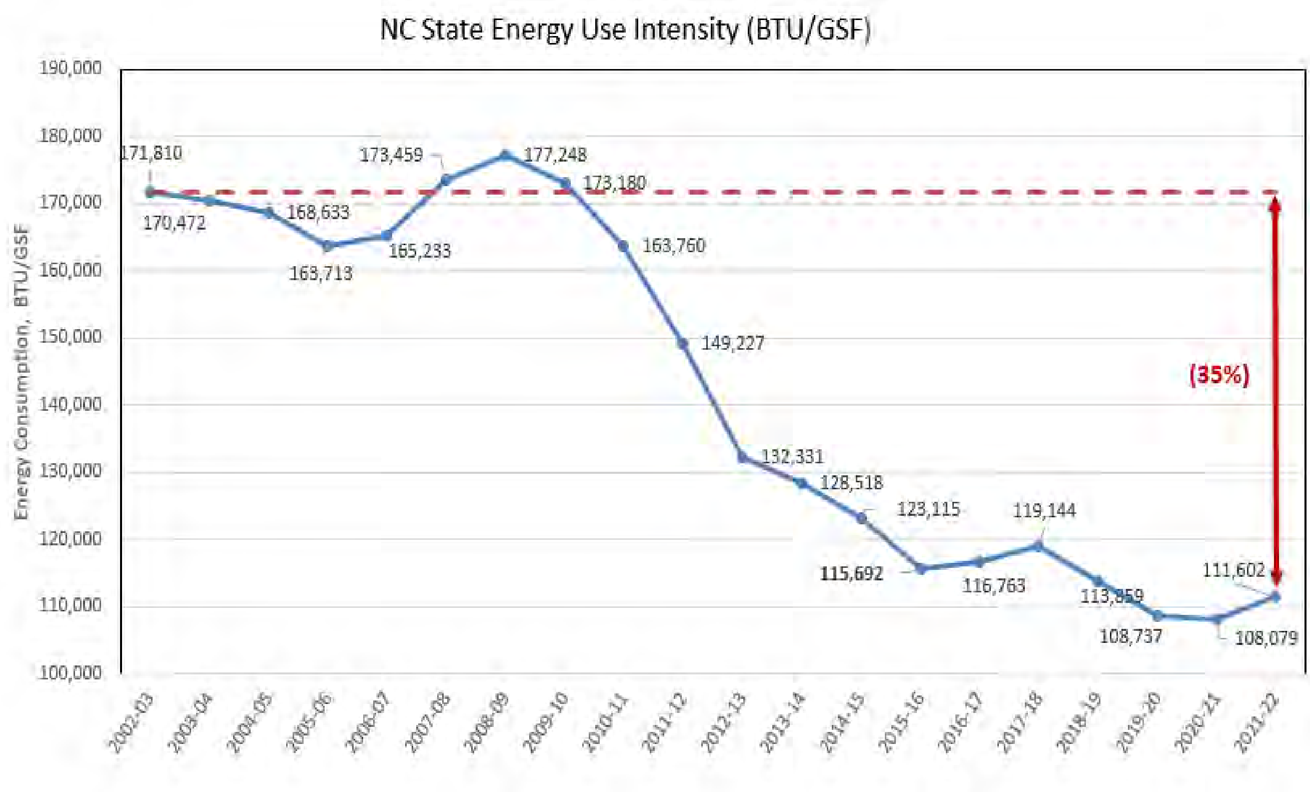


Figure 1- Energy Use Intensity (BTU/GSF)

*Combined Heat and Power Adjustment Methodology: NC State purchases electricity, natural gas, fuel oil, and potable and reuse water from third parties. Electricity is also generated on campus using an 11 megawatt (MW) CHP system. As a result of CHP, fuel use for on-site power generation increases, fuel use for boilers decreases, and grid electricity purchases (or source energy) decreases.

The methodology for reporting the benefits garnered through the operation of CHP follows the U.S Department of Energy measurement protocol outlined by the Federal Energy Management Program in the Reporting Guidance for Federal Agency Annual Report on Energy Management issued October 2018. The purpose of the adjustment is to not penalize organizations under the site energy based performance metric for implementing cost-effective projects where source energy decreases but site-delivered energy increases.

Water

In fiscal year 2016, NC State began utilizing non-potable reuse water supplied by the City of Raleigh on Centennial Campus. Reuse water is wastewater treated to a high standard and reused instead of being discharged into a waterway. Reuse water provides a more cost-effective and drought resistant supply of water for cooling towers, irrigation and toilet flushing. For total water consumption (potable and reuse), fiscal year 2022 marked a level 51% below the FY 2002 baseline with potable water consumption decreased by 59% (see Figure 2).

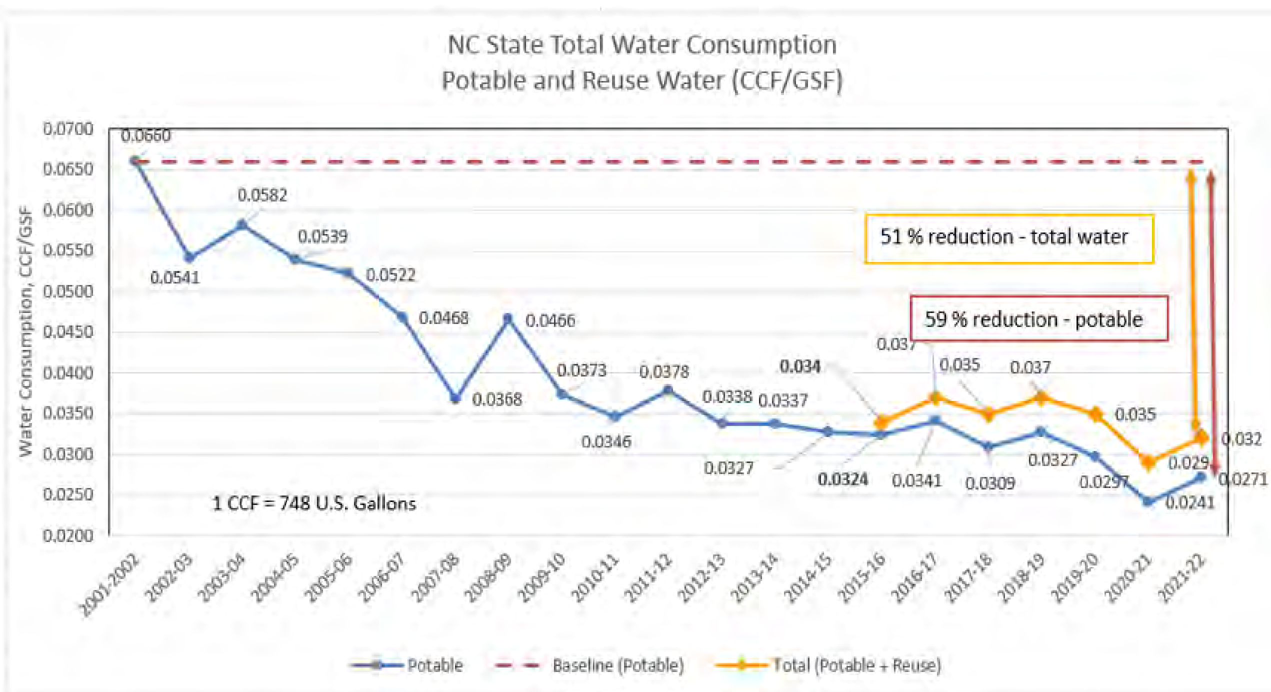
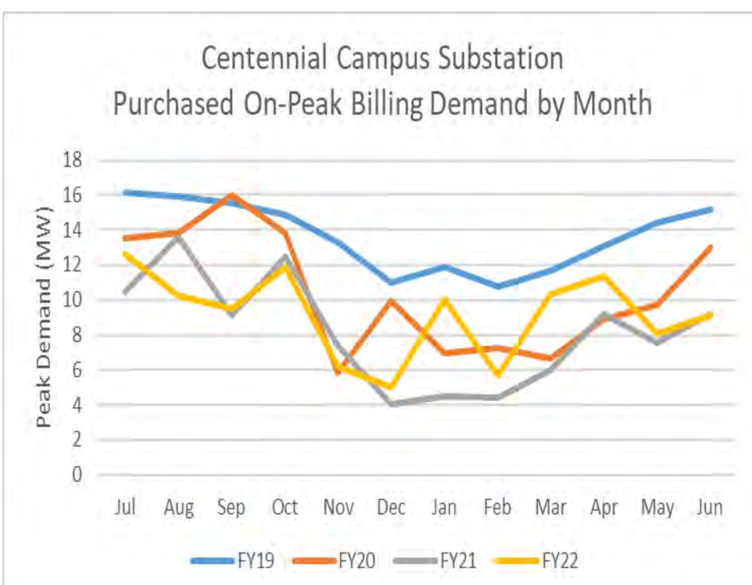


Figure 2- Water Consumption per GSF



Thermal Energy Storage

Figure 3 shows the peak demand at the Centennial Campus Substation. The yellow line is the most recent Fiscal Year. CHP began at the Centennial Utility Plant in Feb 2019, and Thermal Energy Storage started in July 2020. Peak demand continues to be below levels established before both projects were implemented.

Figure 3 - Centennial Demand by Month

Overall Progress

As shown in Figure 4, total Utility Cost per GSF sharply increased in FY22 due to price increases from all utility providers along with significantly higher fuel oil usage. More fuel oil was required because natural gas was curtailed for a total of 245 hours in January 2022 which equates to approximately a third of the month. Although fuel oil was only 3% of the energy purchased, fuel oil accounted for 6% of the total utility cost. For fiscal year 2022, the Total Utility Cost per GSF is $1.93/GSF, which is 2.5% lower than the 2002-2003 baseline. This is despite energy costs which have increased by 39% and water prices that have increased by 347% since fiscal year 2003. Energy and water efficiency gains, coupled with low natural gas prices and Energy Management's strategic purchasing of natural gas, have all contributed to the gradual reduction in Total Utility Cost per GSF. Higher utility prices and severe weather patterns could reverse this trend.

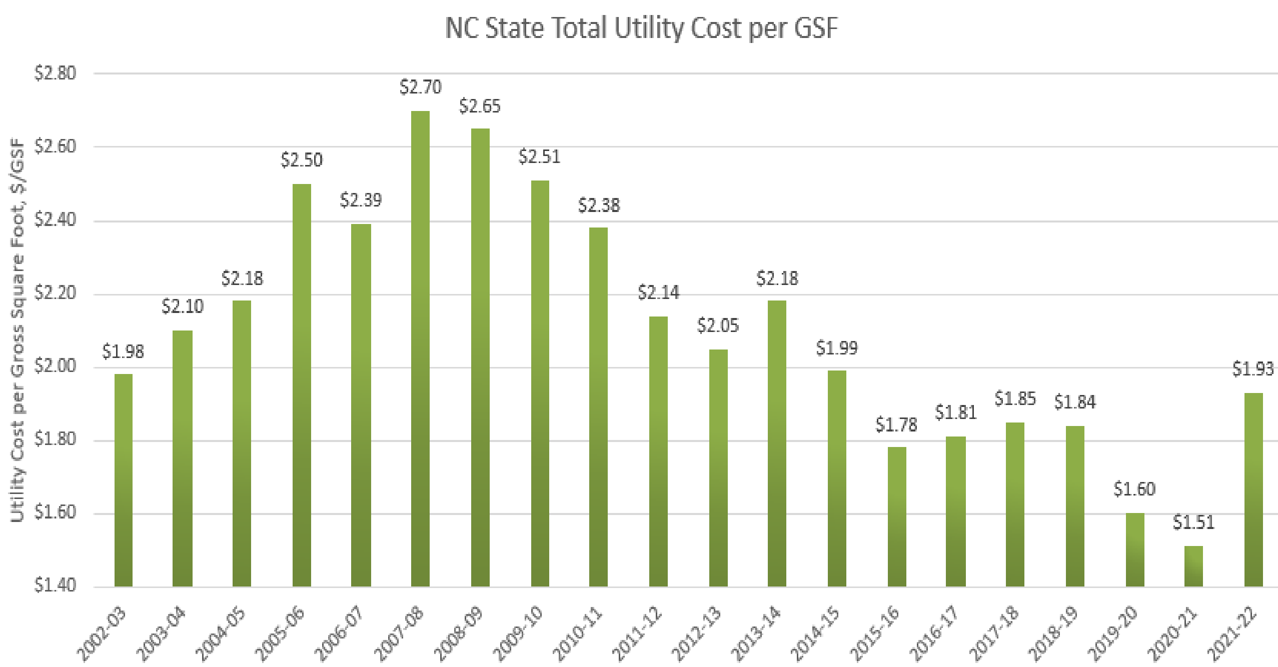


Figure 4- Utility Cost per GSF

Growth vs. Performance

Figure 5 illustrates the university's growth versus Energy Use Intensity over time. As indicated by this figure, although campus GSF has increased by 55% since the 2002/2003 baseline, EUI has decreased by 35%. The university continues to make significant progress in reducing energy use through energy efficiency strategies and efforts by the campus community (see page 3).

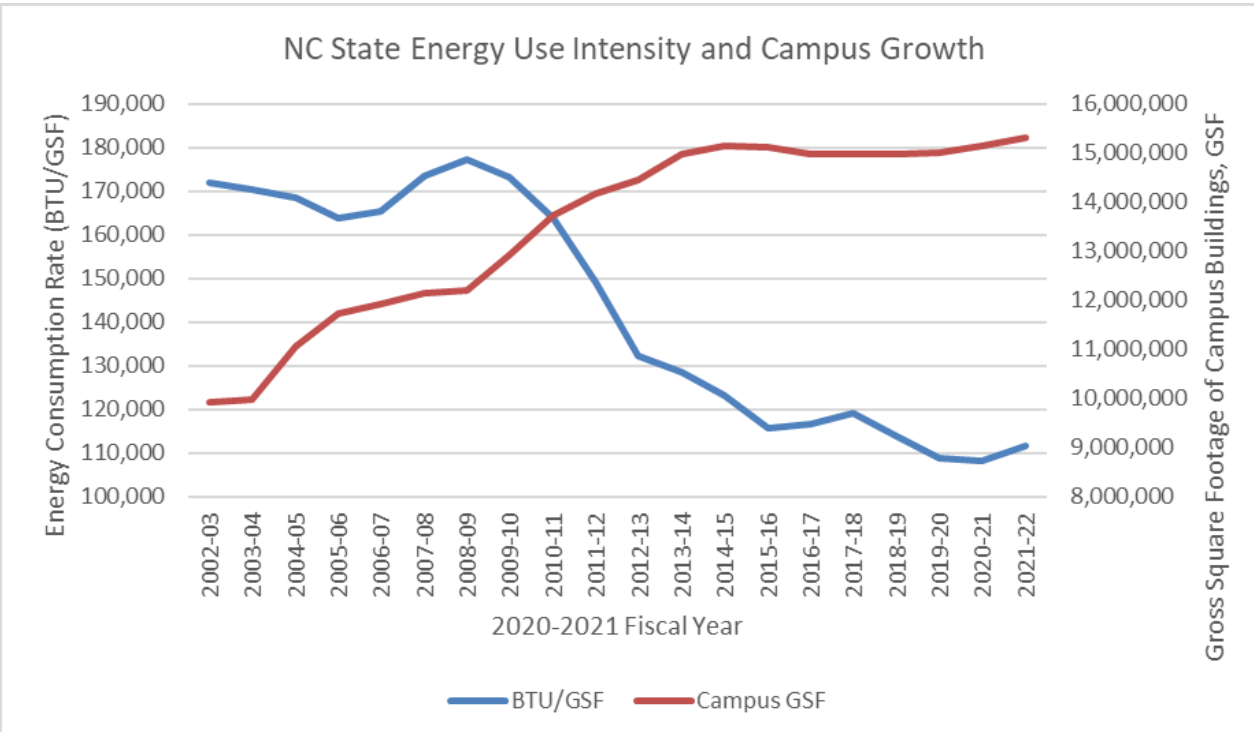


Figure 5- Energy Use Intensity and Campus Growth

Each year, NC State typically purchases approximately $30 million in utilities. During FY2022, electricity accounted for 44% of the utility purchase total. Electricity is the utility most influenced by the campus community and, as such, has the greatest potential for reduction through conservation actions by individuals such as turning off lights, unplugging electronics not in use, closing windows and doors, shutting fume hood sashes in labs and turning off computers not in use. As for other utilities, natural gas was curtailed for a third of January which forced the campus to purchase fuel oil. This accounted for 6% of the utility expense after zero fuel oil was purchased for the prior fiscal year. Figure 6 shows the overall composition of utility and water expenses for FY2022.

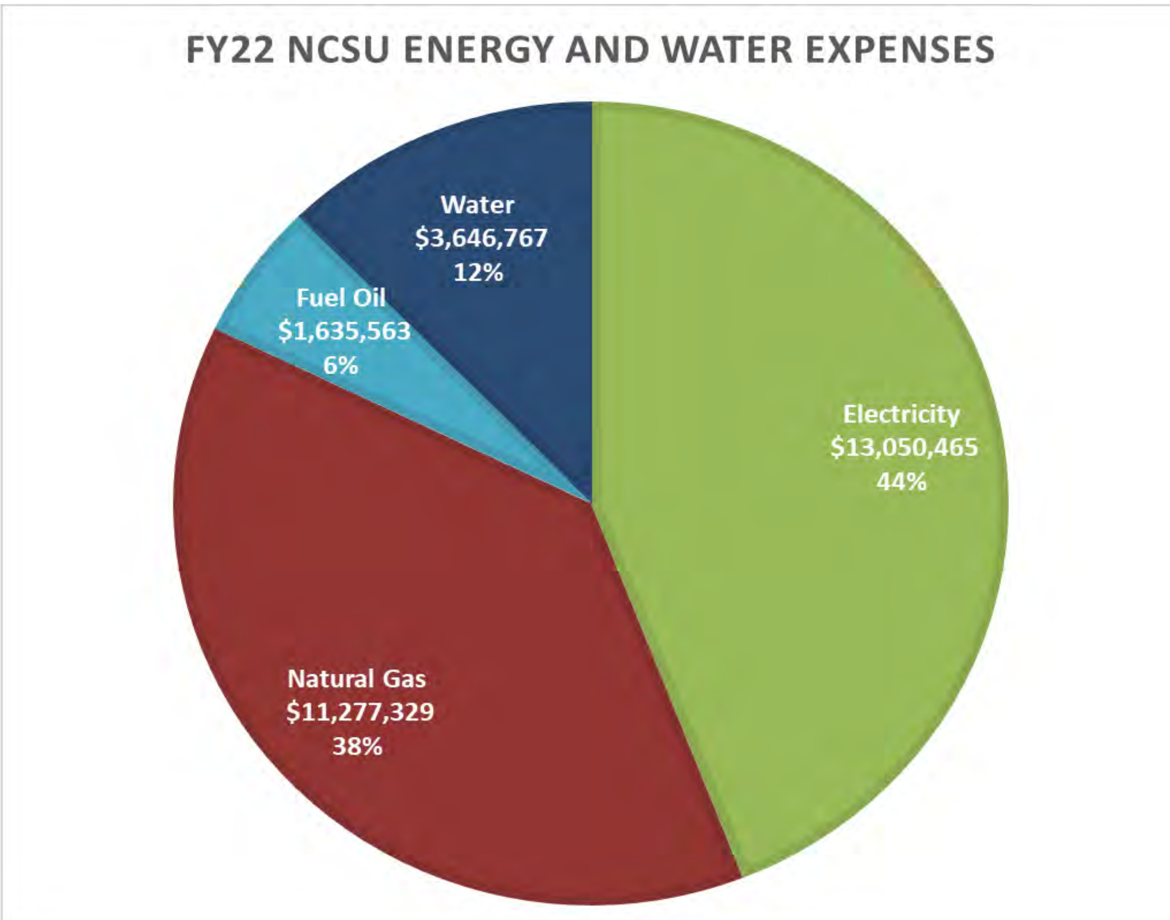


Figure 6 - Energy and Water Expenses FY 2022

Appendix B: Projects

Fiscal Year 2022 Projects Completed			
Project and Location	**Project Cost**	**Est. Avoided Cost (Annual)**	**Simple Payback (Years)**
Holiday Energy Savings Initiative	$ 20,000	$ 416,000	0
ULT Freezer Rebate Program	$ 35,000	$ 5,000	7
Schaub, CVM, and Holmes Hall Recommission	$ 209,000	$ 228,000	1
Headhouse Unit III LED	$ 325,000	$ 130,000	3
Cates Lighting Replacement/Upgrades	$ 12,000	$ 5,400	2
BTEC Lighting Upgrades	$ 7,000	$ 5,000	1
Carmichael Gym Lighting Upgrade	$ 50,000	$ 6,000	8
CBC LOW DELTA T	$ 256,000	$ 53,700	5
Carmichael Rec Center Controls Upgrade	$ 139,600	$ 32,000	4
Controls Upgrades for Various Buildings	$ 279,000	$ 64,000	4

Fiscal Year 2023 Projects Planned			
Project and Location	**Project Cost**	**Est. Avoided Cost (Annual)**	**Simple Payback (Years)**
Holiday Energy Savings Initiative	$ 20,000	$ 380,000	0
ULT Freezer Rebate Program	$ 50,000	$ 10,000	5
Recommissioning - Carmichael Rec, Carmichael Gym, Joyner, EBI, & MRC	$ 760,000	$ 300,000	3
Solar Photovoltaic Array- Fitts-Woolard Hall	$ 500,000	$ 23,800	21
Battery Storage – Centennial Campus Infrastructure	$ 50,000	$ 85,400	1
LED Conversions (Interior Lighting) - CVM Main, Williams Hall, Kamphoefner, Toxicology, Polk Hall	$ 1,918,000	$ 399,500	5
LED Conversions (Exterior Lighting) - South & Centennial Campuses	$ 750,000	$ 277,700.00	3
Controls Upgrades - MRC, PSC, MDF, Alexander Hall, Turlington Hall	$ 500,000	$ 148,300.00	3
Chiller Pump VFD Upgrades - Yarbrough and Cates Utility Plants	$ 409,500	$ 40,000	10
Lab Building Exhaust VAV Conversion, (FOX)	$ 16,600	$ 10,000	2
Engineering Building II Aeroseal Duct Work	$ 84,000	$ 68,000	1
Biltmore Fume Hood Removal	$ 12,000	$ 5,000	2
Annual Steam Trap Survey	$ 2,500	$ 10,000	0

Appendix C: Energy Performance Contracts

EPC Information	Description
Cogeneration on North and Central Campus (2012) - 17-year contract, $56.1 million invested. Cates Plant on Main Campus	In 2012, this project replaced aging boilers in both the Cates and Yarbrough Central Utility Plants with new high efficiency boilers and a cogeneration system. The cogeneration system, or "combined heat and power," utilizes natural gas to produce 11 MW of electricity while the waste heat from the process produces steam. Utility savings are realized due to a reduction in the total cost of electricity and steam production through increased efficiency. In FY22, the Cates Cogeneration plant produced approximately 31% of the university's electricity and helped to reduce the university's greenhouse gas emissions by using cleaner fuel sources and by reducing NC State's reliance on the regional electricity grid. The most recent annual savings for this performance contract was over $8.7 million.
Centennial Campus Cogeneration (2019) - 18-year contract, $17 million investment CCUP on Centennial Campus	The Centennial Cogeneration EPC removed a boiler in the Centennial Central Utility Plant and installed a high efficiency cogeneration system. The cogeneration system includes a combustion turbine generator (CTG) which generates 5.5 MW of electricity, and a steam turbine generator (STG) which is capable of generating an additional 1 MW of electricity from the excess steam. Utility savings are realized due to a reduction in the total cost of electricity and steam production through increased efficiency. In FY22, CCUP's Cogeneration provided over 17% of the university's electricity while helping to reduce greenhouse gas emissions. The most recent annual savings exceeded $1.7 million.
13 Building EPC (2012) - 19-year contract, $19.7 million investment Buildings located on North, Central and Centennial Campuses	The 13 Building EPC encompasses the following buildings: Cox Hall, Poe Hall, Tompkins Hall, Caldwell Hall, Winston Hall, College of Textiles, McKimmon Center, Monteith Research Center, Research I, Dabney Hall, Carmichael Gym, Constructed Facilities Lab and MRC Parking Garage. The EPC included renovations and operational changes with the HVAC systems and fume hood controls, lighting upgrades, water reduction strategies and a solar hot water system in Carmichael Gym. The most recent annual savings exceeded $2 million.
Phytotron EPC (2014) - 15-year contract, $6.2 million investment Located on North Campus	Constructed in 1968, the Phytotron Building performs plant, animal, and insect research by simulating environments from desert heat and drought to Alpine cold and jungle humidity. The Phytoron EPC addressed HVAC and lighting upgrades, a connection to the central chilled water loop, and research equipment improvements. Phytotron's most recent annual savings were over $680,000.

Appendix D: Renewable Energy Implementation

Solar and Storage Options

Expanding NC State's renewable energy portfolio is a significant component of our efforts toward advancing our climate action commitments. As such, multiple strong efforts are on plan across our campus to boost renewable generation and energy storage deployment.

Recently, a 182kW$_{DC}$ Fitts-Woolard Hall PV went through the bid process and was awarded. The project is now in the construction phase for FY 23. Similarly, the centennial campus battery storage is still undergoing State's review. When complete, the storage is expected to shave up to 500kW of the Campus peak demand.

The potential for other new solar installations are in the advanced planning phase. Design and feasibility analysis are being conducted to Install 1.04MW of solar canopies over the parking lot at Varsity Drive. This would allow the university to better understand structural requirements, PV panel and electrical equipment selection, electrical single line design, performance modeling, and provide for a phased construction approach supported by a construction estimate for each phase.

Also, an engineering senior design team is participating in the design of solar arrays at Sullivan shops. This is accompanied by a study to deploy battery energy storage and electric vehicle charging stations at the same sites. Such efforts when completed will provide the feasibility to significantly lessen our campus peaks and to generate more energy savings.

Another partnership effort is being exercised by the college of textiles and facilities to invest in solar energy generation at the Centennial campus. This is still in the conceptual phase of planning. The energy management goal is to move the effort forward to an advanced planning phase gearing towards a formal design.

NC State Solar and Storage Projects

Location	**Description**	**Est. Cost**	**Est. Annual Savings**
Fitts-Woolard Hall	182kW$_{DC}$ Solar PV	$500,000	$23,800
Centennial Campus	500kW 2hr Battery	$431,000	$85,400
Varsity Lot PV	1.004MW$_{DC}$ Solar PV	Not yet Established	Not yet Established
Sullivan Shops PV	Not yet Established	Not yet Established	Not yet Established
College of Textiles	Not yet Established	Not yet Established	Not yet Established

Strategic Energy Plan

The North Carolina Arboretum
100 Frederick Law Olmsted Way
Asheville, NC 28806
(828) 665-2492
www.ncarboretum.org

September 2022

Executive Summary

For 35 years…Cultivating Connections between People and Plants…amid a 434-acre public garden, The North Carolina Arboretum is located within the Bent Creek Experimental Forest just south of Asheville and adjacent to the Blue Ridge Parkway at Milepost 393. Surrounded and crisscrossed by forested coves and meandering creeks in the botanically diverse Southern Appalachian Mountains, The North Carolina Arboretum is set in one of the most beautiful natural settings in America.

The Arboretum was established as an affiliate of the University of North Carolina by the State General Assembly in 1986, nearly a century after Frederick law Olmsted, the Father of American Landscape Architecture, first envisioned a research arboretum as part of his legacy and plan for George Vanderbilt at Biltmore Estate.

Located on land within the Pisgah National Forest, the Arboretum is operated under a special use permit issued by the National Forests in North Carolina. This permit does not give the Arboretum the authority to allow commercial activities on National Forest land.

Because of our size and our dedication to our institutional mission, which includes conservation, we already exhibit many of the characteristics of an energy-conscious organization. Our discussions below are more a reflection of our inherent energy leadership and management goals and operations.

The North Carolina Arboretum's utility mix is approximately 75% electricity, 13% natural gas and 12% water. Currently, we have 82,480 square feet of space and last year we spent $115,636.00 in total utilities. Since 2002-2003 when this program started, we have reduced our BTU/Sqft by 28%, avoiding over $570,000 in additional costs. Annually the Arboretum by being good stewards of state resources avoids $73,000 of unneeded utility costs. These continued efforts are part of our everyday culture. We are committed to meeting at least the minimum 2% savings goal in BTU/Sqft, and we believe that by continuing to monitor utility expenditures, perform routine maintenance, buy the most efficient energy using equipment and keeping staff aware of utility issues, we will be able to meet this goal.

Improved energy and cost management must become a vital initiative and an integral part of TNCA's strategic plan. Energy must be recognized as a controllable operating expense wherein savings are available for other program needs. All staff and administration have important roles to play in a successful energy management program.

The Arboretum's Current Key Performance Indicators

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
	$1.34	$14.09		95,388			$3.97		50.95	
-$4,710	$1.58	$15.41	9%	102,703	8%	$0	$0.00	0%	0.00	0%
$14,256	$1.38	$17.00	21%	80,930	-15%	$63	$3.00	-24%	50.47	-1%
$18,414	$1.49	$18.78	33%	79,584	-17%	$44,527	$16.47	315%	7.40	-85%
$7,008	$1.66	$18.62	32%	89,323	-6%	$3,384	$3.27	-18%	34.27	-33%
$38,802	$1.37	$19.41	38%	70,792	-26%	$14,225	$4.97	25%	15.73	-69%
$64,925	$1.36	$22.61	60%	60,053	-37%	$7,846	$3.73	-6%	25.05	-51%
$36,867	$1.32	$18.62	32%	71,034	-26%	$6,624	$3.79	-5%	29.43	-42%
$39,468	$1.35	$19.23	36%	70,141	-26%	$6,658	$3.92	-1%	30.06	-41%
$45,682	$1.31	$19.59	39%	66,095	-30%	$6,714	$3.97	0%	30.15	-41%
$40,267	$1.32	$19.08	35%	69,427	-27%	$6,152	$4.34	9%	27.84	-45%
$37,910	$1.35	$18.97	35%	71,164	-25%	$6,486	$3.97	0%	31.16	-39%
$35,094	$1.39	$19.05	35%	73,048	-23%	$5,938	$3.96	0%	32.78	-36%
$37,881	$1.31	$18.51	31%	70,575	-26%	$4,063	$3.92	-1%	38.39	-25%
$39,855	$1.25	$18.18	29%	68,811	-28%	$4,174	$3.95	0%	38.15	-25%
$32,890	$1.30	$17.85	27%	73,050	-23%	-$5,992	$2.94	-26%	75.69	49%
$37,852	$1.36	$19.02	35%	71,256	-25%	-$10,211	$3.68	-7%	84.55	66%
$52,966	$1.28	$20.20	43%	63,598	-33%	-$22,720	$3.68	-7%	125.72	147%
$51,764	$1.21	$18.24	37%	62,761	-34%	-$5,139	$4.02	1%	66.46	30%
$73,606	$1.45	$24.59	74%	59,093	-38%	-$9,462	$3.94	-1%	80.07	57%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%
$0	$0.00	$0.00	0%	0	0%	$0	$0.00	0%	0.00	0%

Last Year's Projects 2021-22

- Multiple irrigation repairs on campus to reduce energy and water waste
- Replacement of pumps associated irrigation system
- Renovate heat pump system in the operations facility
- Renovation of the heat pump in the Campus Police Trailer

Next Year's Projects 2019-20

- Repair roof leaks in Operations Center Roof and seal windows for additional efficiency.
- Upgrade and replacement of Baker Heat pumps.
- Upgrade doors in Baker for better operation and seal
- Replace front doors in the Baker Exhibit Center to create a more secure air lock and to avoid the need to prop-doors open
- Install systems to enable remote access to the automated logic system to enable cross campus collaboration.
- Continuous improvement process on planned maintenance on critical equipment such as HVAC filters and cooling coils.
- Replace and insulate Education Center Roof
- Modernize/Replace Education Center HVAC system

Annual Objectives for Energy Efficiency

- We need to better track each buildings energy usage monthly and develop some Key Performance Indicators. With the help of the State Energy Office, we will work to identify these KPIs that will work for the Arboretum. We have implemented an energy tracking system that will feed graphical data into our Budget Tracking System for all managers to see.
- Annually work with each utility provider to go through each account to verify that we are on most advantageous rate.
- Continually seek low/no cost ways to improve utility systems operation.
- Establish a plan for monthly reporting of energy efficiency.
- Work with all entities like the State Energy Office to identify funding sources
- Send facilities staff to State Energy Conference.
- Continue to use R and R funds for projects and make sure that energy efficiency is factored in to all projects.
- Continue to look for ways to incorporate renewables here at the Arboretum.
- Continue to work with the HVAC Control system to identify system function improvements and other control issues that could save energy and money.
- Maintain staff training to ensure adequate knowledge of Arboretum systems and new technologies.
- Establish an "Energy Awareness Program" to promote a sense of responsibility and aligned action among all staff.
- Implement a program to perform energy audits and system evaluations of facilities found to have higher than normal usage and cost, and identify reduction opportunities.
- Keep awareness up for all guest and attendees of the Arboretum to make sure we get their participation with our efforts to be good stewards of all of our resources.

An Energy Mandate for The North Carolina Arboretum

We recognize energy as a controllable expense wherein savings result in reducing overall operating cost. Energy management is a responsibility of the staff of The Arboretum, guided and supported by the Facilities Management Team and the Utility Manager.

- Brad Shore is responsible for implementation of the Arboretum Strategic Energy Plan with support of all staff. Only if all staff participate will this SEP be successfully implemented.
- The Leadership Team shall review progress and results quarterly.

Energy Mandate – Goals

The Arboretum will reduce annual Total Baseline Energy intensity in BTU/sqft by a minimum of 2%. The goal for energy efficiency in each facility is to equal or better the state average for energy cost of $1.00 per SF.

Energy Mandate – Measures

Our tracking measures will be:

- Total Utilities Cost per Square Foot
- Electric KWH Use per Square Foot
- Total Gallons Water Use per Square Foot
- Gas Btu Use per Square Foot
- Electric KWH Used per Acre of Type A and B Demonstrations & Exhibits
- Total Gallons Irrigation Water Used per Acre of Type A and B Demonstrations & Exhibits
- Total Gallons Irrigation Water Well-Drawn per Acre of Type A and B Demonstrations & Exhibits

Energy Mandate – Commitment

Implemented this 27 day of September, 2022.

Executive Director George Briggs

Chief Finance Officer

This **Energy Mandate** serves as a **Memorandum of Agreement** to support Strategic Energy Planning for state government.

Strategic Levels of Energy Efficiency

Appendix 1

Level	Energy Data Management	Energy Supply Management	Energy Use In Facilities	Equipment Efficiency	Organization Integration
Basic	Monthly Bills Regular Review	Error Correction Billing Evaluation Rate Improvement Account Management	Partial Walk-thru Facility Ranking Hi Cost Fac ID Improvement Opps.	Corrective Maintenance Prog. Equipment List Control System	Energy Manager Adequate Time Train SEP to all staff
Advanced		Forward Pricing Reliability Alternative fuels Renewables	Improvements ID Written Procedures Total Systems Control Total Impact Evaluation	Full on Preventive Maintenance Total Lighting Upgrades Alternate Fuel Eval.	Total Cost Impact Use/Cost Planning Oversight Team Accountability Assigned
Aggressive	Sub-Metering all utilities Sub-metering largest energy using devices	Load Shift Analysis, not useful Risk Management Mirco-grids	New Facility Testing Monitoring	Facility Renovations New Standards Commissioning	Recognize and Reward Energy Champions

The University of North Carolina at Chapel Hill

Strategic Energy & Water Plan – FY23

Prepared by George Jacobs, PE

UNCCH Facilities, Engineering Services, Energy Management

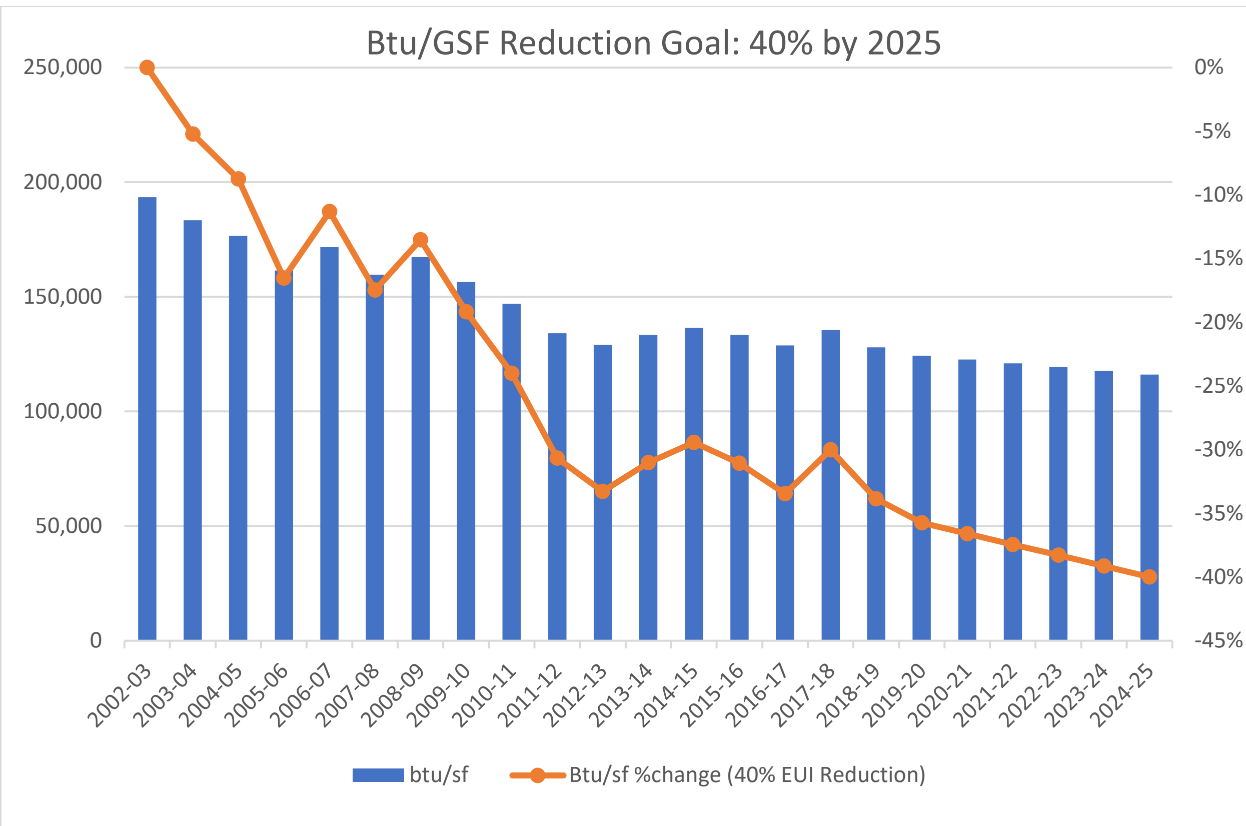
8/15/22

Overview

The Strategic Energy and Water Plan is a requirement of NC GS 143-64.12. (a). This legislation includes a past goal of 30% reduction of energy consumption per gross square foot for all State buildings by 2015 based on energy consumption for FY2003. UNCCH achieved this mandated goal and has continued to show annual energy reductions ranging between 31% and 37%. These efforts have resulted in an impressive $524M of cumulative avoided energy cost since FY2003 for UNCCH.

To encourage increased energy savings, the UNC System has established a new goal of 40% reduction of energy consumption per gross square foot by 2025 based on energy consumption for FY2003. This is a voluntary goal with no current legislative requirements. This goal aligns with the Governor's Executive Order 80, requiring a 40% reduction of energy consumption for all Cabinet Agencies. The goal also aligns with filed HB 330 (2019-20 Session) that remains in committee review. The purpose of the Strategic Energy and Water Plan is to identify strategies for achieving the 40% reduction goal; including outreach programs, energy conservation measures, design guidelines, and alternative energy sources. The plan also includes cost estimates and energy savings analysis.

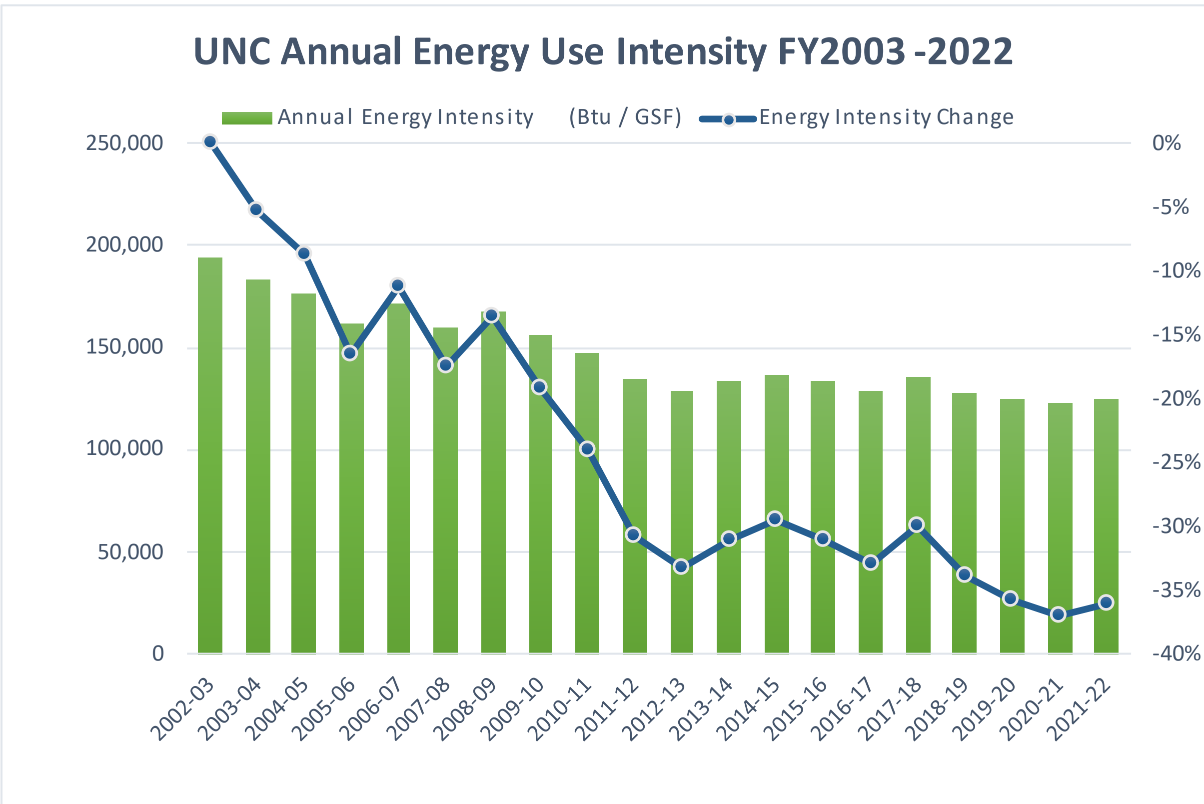
The graph below demonstrates the campus btu/gsf to achieve the 40% reduction goal.

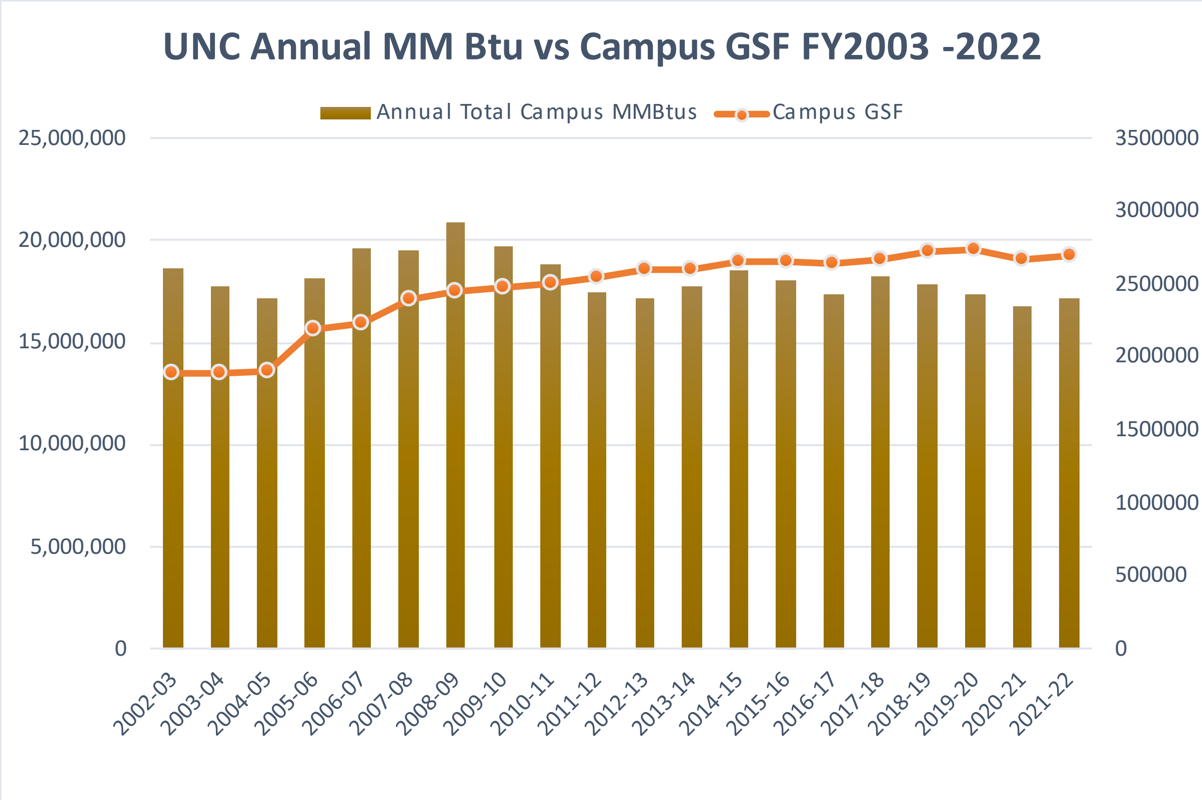


FY22 Energy and Water Report Metrics and Trends

Energy Usage

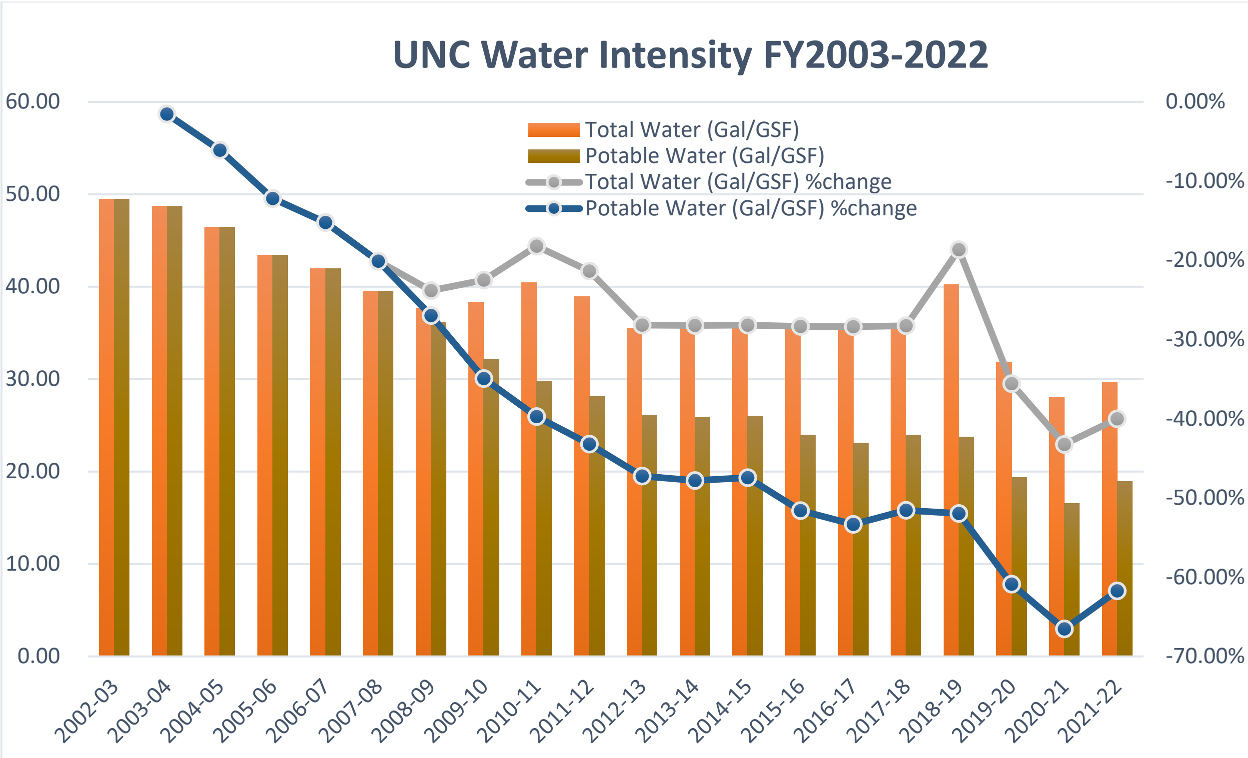
For FY22 Energy and Water Reporting, the University of North Carolina at Chapel Hill campus consisted of 408 buildings with a combined building area of 19,290,488 gross square feet. For FY22, the total campus energy consumption is 2,398,894,282,952 Btu. Energy consumption per gross square foot is 124,356 Btu/GSF; a 36% decrease from FY03 energy consumption of 193,500 Btu/GSF. For base reporting year FY03, the total energy consumption was 2,607,959,528,644 Btu for a campus size of 13,477,719 GSF. Although the campus has experienced a building GSF growth of about 43% since FY03, the overall campus energy consumption has decreased by 8%.





Water Usage

Potable water use for FY22 is 365,121,000 gallons. Potable water consumption per gross square foot is 18.93 gallons/GSF; a 62% decrease from FY03 potable water consumption of 49.48 gallons/GSF. The reduction in potable water use is a result of increased use of non-potable water from the Reclaim Water utility on campus and the use of captured rainwater and condensate from cistern storage. The Reclaim Water utility became available in FY09 and use of this utility has increased from 27,054 gallons in FY09 to 207,248 in FY22. The Covid Pandemic and resulting overall decreased occupancy in campus buildings has also impacted water consumption on campus contributing to reductions in overall water use, both potable and non-potable.



FY23 Strategies/Impacts

Pandemic Impact

The COVID-19 pandemic continues to have varying impacts on energy consumption related to on-campus occupancy and heightened awareness of importance of good building ventilation. Although the campus had a full re-opening in July 2021, a portion of campus staff continued to work in a hybrid arrangement of on-site and off-site. Facilities is continuing to address ventilation concerns and has implemented outside air damper replacements and repairs in about 20 buildings. Building operation practices continuing from FY21 are relaxed building schedules to allow for increased flushing of air prior to and following occupancy each day; and for areas with higher risk activities, outside air ventilation has been increased or supplemented with portable HEPA filtration units. UNCCH also increased filtration level to MERV13 or higher for main air handling equipment that have box filters. Energy Management has not attempted to calculate any energy consumption changes related to these changes.

Ongoing Initiatives

Low Cost ECMs and Monthly Monitoring of Building Energy Use. Energy Management has implemented low cost ECMs in 150 major buildings on campus. These 150 buildings represent about 12,000,000 GSF or about 62% of the total campus GSF. Energy Management generates monthly energy forecast reports for these 150 buildings to identify higher than expected energy use by utility allowing for more timely intervention. Maintenance issues are addressed through the maintenance work order system. Other continued low performers are targeted for retro-commissioning opportunities, including improved control sequences, tuning of control loops, and calibration of sensors. Based on our forecasting model for FY22, this initiative contributed to an avoided energy cost of $2.3M and avoided energy usage of 70,801,826 kBtus.

Winter Break. The University conducted its annual Winter Break Saving Initiative that focuses on aggressive scheduling of buildings during the 10-day campus closure (Dec 24 – Jan 2).

Target EUIs for Buildings by Type. Energy Management participated with a UNCCH capstone project in FY20 to establish target EUIs for each of the building types on campus. This will be another energy analysis tool that will help identify low energy performers and creating a more targeted and coordinated approach to defining and implementing ECMs in low performing buildings. Energy Management is also hoping this will be useful tool in selling the value of including energy improvement components in capital projects, including Repair and Renovation projects. Energy Management is planning to make greater use of this analysis during FY23.

New Building Construction/Major Building Renovation. New buildings and major building renovations on campus require designs to meet the Performance Standards for Sustainable, Energy-Efficient Public Buildings (NCGS 143-135.35-40). Designers are required to model the buildings for energy performance and to evaluate life cycle costs of building/energy systems that result in energy savings over life of the building. The UNCCH team is actively engaged with energy performance throughout the design and construction process, including comprehensive commissioning of the building envelope, building HVAC control systems, and building electrical systems. The Medical Education Building is still under construction (Target Completion in late fall 2022) with a designed EUI target of 104. This target EUI falls within our campus target EUI of 116 to meet the 2025 goal.

Campus Engagement. Energy Management is actively engaged in many outreach programs on campus, including participation in new student orientation, Green Labs, UNCCH Housing Sustainability, UNCCH Three Zeros, RESPC Student Green Fee Organization, student Capstone projects, and student interns through the EcoStudios program and the Sustainable Triangle Field Site (STSF) programs. The programs allow UNCCH Energy Management to educate campus partners about energy savings opportunities and to assist groups with implementing changes that result in energy reduction. It would be very challenging to calculate energy savings specific to these efforts; however, UNCCH Energy Management believes engaging with campus partners is impactful and helps gain support of other initiatives.

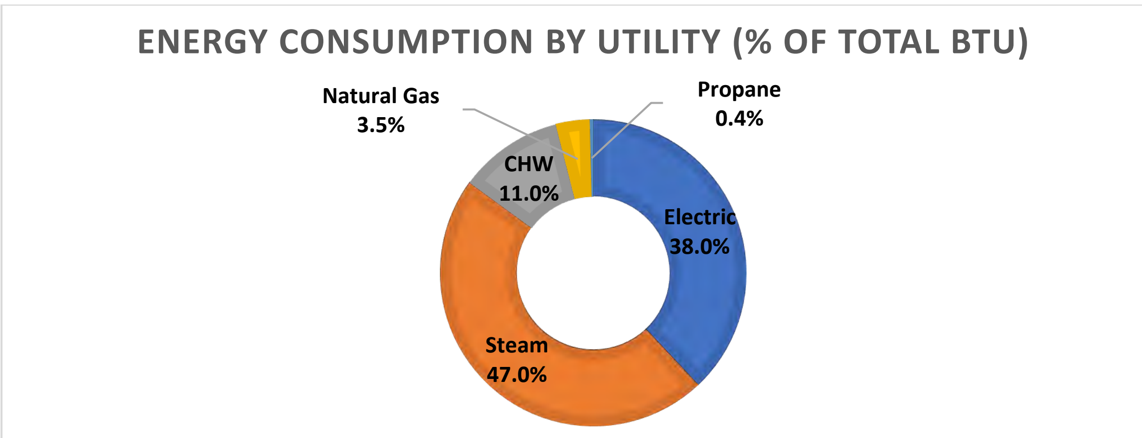
Energy Projects

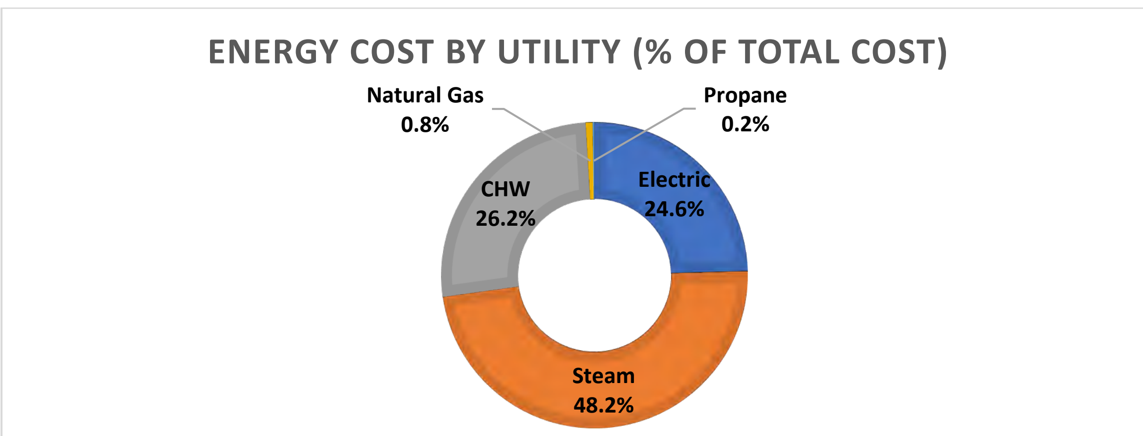
For FY23, UNCCH is utilizing 1292 funds to implement three energy projects: Thurston Bowles Building Air Flow Reduction, Taylor Hall Air Flow Reduction, and Chapman Hall Air Flow Reduction. As part of a revised budget model, Energy Management is hoping to have access to future annual 1292 funds to target energy projects.

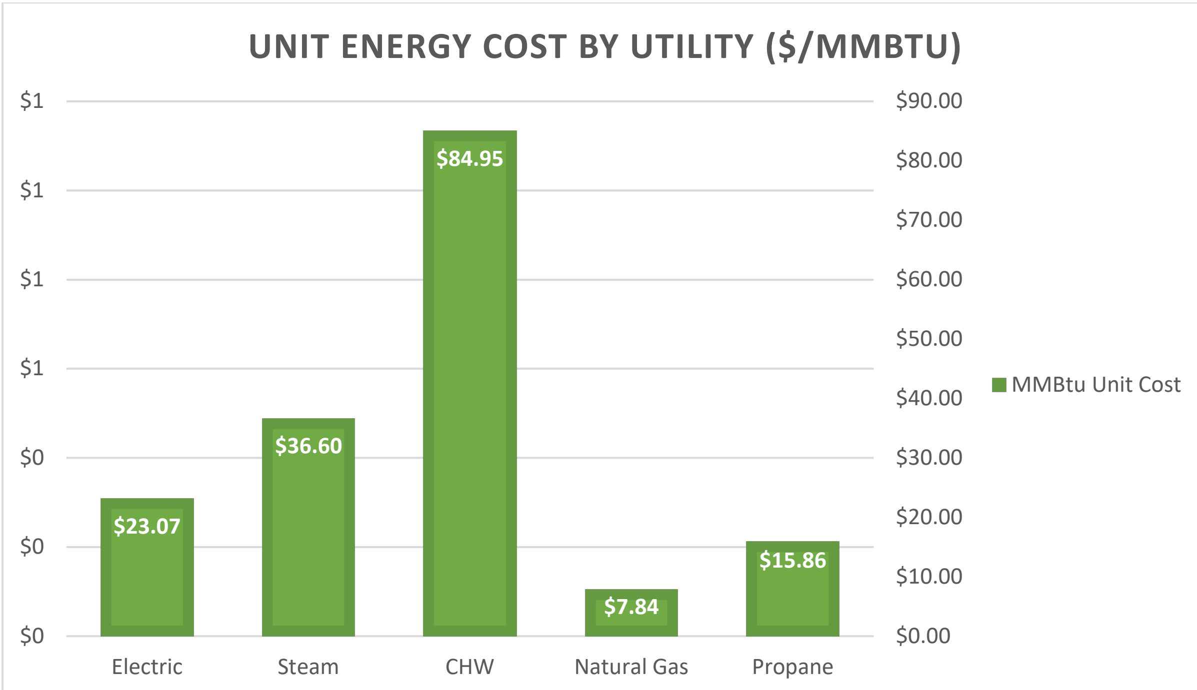
Campus Utilities

Energy

Consumption and Cost by Energy Type. Energy on the UNCCH campus is supplied by UNCCH Energy Services and consists of electricity, district chilled water, district steam, natural gas, and propane. The campus electricity is sourced from Duke Energy Carolinas and the UNCCH Co-Gen plant. Each utility is metered at the building level with a few exceptions for steam to hot water convertors that serve multiple buildings. UNCCH Energy Services establishes the billing rates for these utilities. For FY22 energy consumption by category, cost, and unit cost are demonstrated in the following graphs.







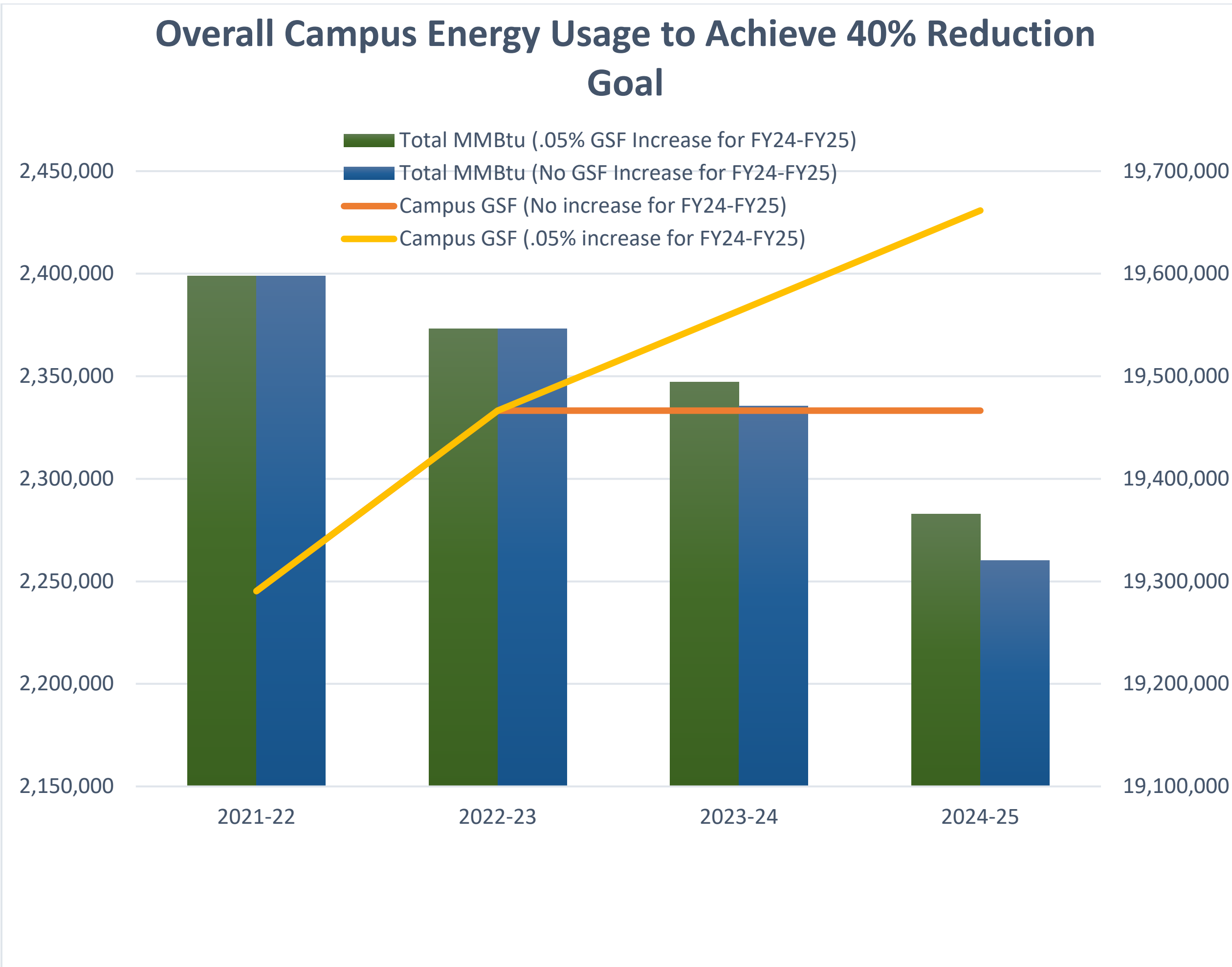
Renewable Energy Projects. UNCCH Energy Services has several active renewable energy projects. The largest of these active projects is the installation of a ground mounted solar array, 376kWac. The planned battery storage component of the project has been removed from the current scope due to budget constraints. Project includes provisions for future battery storage. This project is sited on the Carolina North campus and connected to the electric grid that supplies power to the current north campus buildings. The other two renewable projects are the more traditional rooftop solar arrays planned for Friday Center (70.7 kW) and the Carroll Hall Addition (25.2 kW) projects. These two projects are being funded through RESPC, the student green fund organization. The UNCCH Kenan Flagler Business School is actively seeking renewal energy options as part of the design of the Business School Addition. The design team is pursuing an aggressive EUI target of 46.4 with expectations of further reductions from the use of rooftop solar, an estimated 484kW combined.

Water

Water, reclaim water, and sanitary sewer utilities are provided by Orange Water and Sewer Authority (OWASA); however, these utilities are managed and billed by UNCCH Energy Services. In FY20, OWASA provided UNCCH with water analytics software, Aqua Vista, that provides interval water use data that can be trended and used for notifications, including leak detection. UNCCH Energy Services and UNCCH Energy Management have started using this analytic tool to provide earlier detection of water leaks and to identify high water consumers in different user categories. This tool appears to have high potential for providing timely information that can lead to decreased water consumption. UNCCH Energy Services and UNCCH Energy Management have partnered with student interns over the past five semesters to perform some initial analysis of the data.

FY25 Goal of 40% Reduction in Energy Consumption per GSF

The FY25 goal of 40% reduction in energy consumption per gross square foot from base year FY03 is equivalent to 116100 Btu/GSF and represents an estimated $52.7M avoided energy cost for FY25. The new Medical Education Building is coming on line in FY23 generating an increase of 176,000 to the overall campus GSF of building area. Assuming a campus growth of 0.5% per year for FY24 and FY25, the overall campus Btu in FY25 must not exceed 2,282,731 MMBtu to meet the goal of 116100 Btu/GSF. Graphs below show projections and values to meet the FY25 goal.



In identifying strategies to achieve the 40% goal, this report assumes no increased building SF as a conservative approach in establishing the required reduction in energy usage. Even though the ongoing initiatives listed earlier in the report will still be pursued, this section identifies specific efforts and projects.

Strategies

LED Lighting Upgrades. UNCCH is continuing to convert campus lighting to LED. LED fixtures are standard for new construction, including small upfit projects across campus. Exterior lighting has been a prime focus with about 97% conversion to LED lamps. Work on a Campus LED Master Plan has been deferred because of limited staff resources although specific projects are still being pursued. UNCCH Transportation has a LED Master Plan for Parking Decks and Surface Lots and multiple LED lighting retrofit projects in design and construction. Three parking decks were completed in FY21 and a fourth deck retrofit will be bid in FY23. The completed LED lighting projects for the parking decks have demonstrated significant energy savings of about 50%. Other LED lighting retrofit projects being planned are conversion of T5 fluorescent to LED and T8 fluorescent to LED. UNCCH Energy Management has mentored several student interns that evaluated LED retrofit projects. In the current product market, their evaluation indicated the use of LED direct replacement lamps in newer fixtures provided the shortest payback period and allowed for flexibility of installation by in-house staff. Several of these type of LED retrofits appears in the project list across all years.

Focus on Steam Use Reduction in Lab Buildings. Steam use on the UNCCH campus accounts for almost 50% of the campus energy consumption and about 50% of the campus energy cost by utility. Since it is also a significant contributor to GHS emissions, focus on reducing use of this utility has good potential for energy savings and GHG emission reductions. The UNCCH campus supports significant research in energy intensive laboratories. About one-third of the campus steam usage is consumed by 20 of these laboratory buildings. Current efforts to reduce steam usage in these buildings include retrofitting steam sterilizers (autoclaves) with scheduling programs, identifying steam stills that can be replaced with more energy efficient RO/DI systems, and checking for leak by on steam valves. UNCCH also operates an in-house steam trap inspection and repair program that inspects each building once per year. UNCCH Energy Management estimates these efforts will result in 10% reduction in steam usage for 22 targeted lab buildings, representing about 23,770 MMBtu of steam reduction. The autoclave retrofit with scheduling function is being funded by the student green fee group (RESPC). Autoclave scheduling retrofits have been completed in three lab buildings with a measurable impact.

Airflow Reduction in Lab Buildings. Many of the older research labs on campus are operating with air change rates in excess of 9 air changes per hour (ACH). This ventilation rate requires a tremendous amount of energy to heat/cool/dehumidify the single pass outside air requirement. Current lab standards consider 6 ACH to provide for safe working environments. UNCCH Energy Management and UNCCH Environmental Health & Safety have been partnering to identify lab buildings where airflow reduction projects are feasible and impactful on energy use reductions. For FY22, UNCCH secured 1292 funds for implementing airflow reduction projects in three campus buildings: Thurston Bowles Building, Taylor Hall, and Chapman Hall. These three projects will be bid in Fall of 2023 with completion targeted for end of FY23. The Covid Pandemic has greatly impacted manufacturing and supply chains resulting in significant project cost escalations creating continued holds on some projects, including three future projects planned for Lineberger Cancer Research Center, Glaxo Research Building, and Fordham Hall. The three current projects represent an estimated energy reduction of 38,726,385 kBtu and the three planned projects an estimated reduction of 23,811,338 kBtu. One of these buildings will be targeted for funding with the FY23 1292 funds.

Expanded HVAC Scheduling in Athletic Buildings. Athletic buildings have sporadic occupancy scheduling based on nature of the activities occurring is these buildings. As such, it is very challenging to establish fixed occupancy scheduling for HVAC equipment setbacks and shutdowns. UNCCH Energy Management is investigating opportunities to use interactive occupant scheduling tool that provides scheduling information to the BAS to establish unoccupied hours for these buildings. Events to HVAC is one brand of this type of occupant scheduling tool and it is being successfully used at the Student Activity Center on campus. For Fall Semester 2023, Energy Management is hosting a EcoStudio Student Intern that will be investigating impact of HVAC scheduling in the Athletic Buildings as their study project. As UNCCH Energy Management develops more detailed scope, these projects/initiatives will be added to each year's project list.

HVAC Building Controls Upgrades. A significant number of buildings on campus have outdated HVAC control systems. The oldest of these are pneumatic control systems with no remote visibility. There is also older direct digital control (DDC) based systems that are obsolete and no longer supported by the vendor. These older software systems are also not compatible with newer Windows operating systems and are presenting numerous IT challenges. UNCCH has partial funding to implement this upgrade and although design work started in FY21, progress has been slow due to several bidding challenges, including impacts of the Covid pandemic. Installation of updated controllers, gateways, and software provides expanded opportunities for energy savings through programming of the building automation system, enhanced trending, and enhanced remote graphics. As UNCCH Energy Management develops more detailed scope, these projects/initiatives will be added to each year's project list.

Building Controls Optimization. Utilizing in-house resources and expertise UNCCH Energy Management is able to assess building controls operation and strategies then implement modifications to optimize operation of building HVAC systems with respect to energy consumption.

FY22 Project Status

FY22	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Energy Management Programs						
Building Optimization	4331	49144	1335844	10,308,544,931	NA	on going
Steam Reduction						
Autoclave Scheduling	2,309	103,402	312,065	4,309,746,104	$77,000	complete
10% Steam Usage Reduction - 22 Target Buildings	18,264			23,769,865,440	NA	on going
				38,388,156,475	$77,000	
Notes						
1. Steam reduction will focus on repairs and calibrations many to be accomplished through maintenance budget						

FY23 Projects

FY23	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Thurston Bowles - Air Flow Reduction	5160	1272413	3009847	19,937,333,310	$2,477,000	Funding Approved - FY22 1292
Taylor - Airflow Reduction	1378	339677	644967	4,782,144,272	$1,658,000	Funding Approved - FY22 1292
Chapman - Air Flow Reduction	6965	713036	1042677	14,276,640,430	$616,700	Funding Approved - FY22 1292
Energy Management Programs						
Building Optimization	4331	49144	1335844	10,308,544,931	NA	on going
Steam Reduction						
Autoclave Scheduling	3,848	172,336	520108	7,182,733,743	$70,000	Pending Approval - Possible Student Green Fee
10% Steam Usage Reduction - 22 Target Buildings	18,264			23,769,865,440	NA	on going
LED Lighting Projects						
Genetic Medicine: T5 Fluorescent to LED			839020	2,862,736,240	$190,000	Funded by Sustainable Carolina
Jackson Parking Deck			241516.8	824,055,322	$500,000	Funded by Parking & Transportation
				83,944,053,688	$5,511,700	
Notes						
1. Steam reduction will focus on repairs and calibrations many to be accomplished through maintenance budget						

FY24 Projects

FY24	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Lineberger - Airflow Reduction	8229	439168	487405	13,391,680,227	$4,700,000	Phase 1 Targeting FY23 1292 Funds
Energy Management Programs						
Building Optimization	4331	49144	1335844	10,308,544,931	NA	on going
LED Lighting Projects						
Caudill Labs: T5 Fluorescent to LED			328320	1,120,227,840	$54,300	Targeting Sustainable Carolina Fund
				24,820,452,998	$4,754,300	

FY25 Projects

FY25	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Fordham Hall - Controls Upgrade & Airflow Reduction	875	215694	980260	4,958,846,981	$1,619,000	Targeting FY24 1292 Funds
Carroll Hall - VAV Zone Control Upgrades	535	182365	128773	1,537,614,755	$1,040,000	Targeting FY24 1292 Funds
Tate-Turner-Kuralt - Add VFDs to HW System			17141	58,485,092	$27,000	Targeting FY24 1292 Funds
MBRL/Glaxo - Glaxo Airflow Reduction	3128	198196	294237	5,534,749,955	$1,208,600	Targeting FY24 1292 Funds
Energy Management Programs						
Building Optimization	4331	49144	1335844	10,308,544,931	NA	on going
LED Lighting Projects						
House Undergrad Library			596951	2,036,796,812	$62,300	Targeting FY24 1292 Funds
Health Sciences Library			563890	1,923,992,680	$78,400	Targeting FY24 1292 Funds
Sitterson			1566960	5,346,467,520	$410,000	Targeting FY24 1292 Funds
				31,705,498,727	$4,445,300	

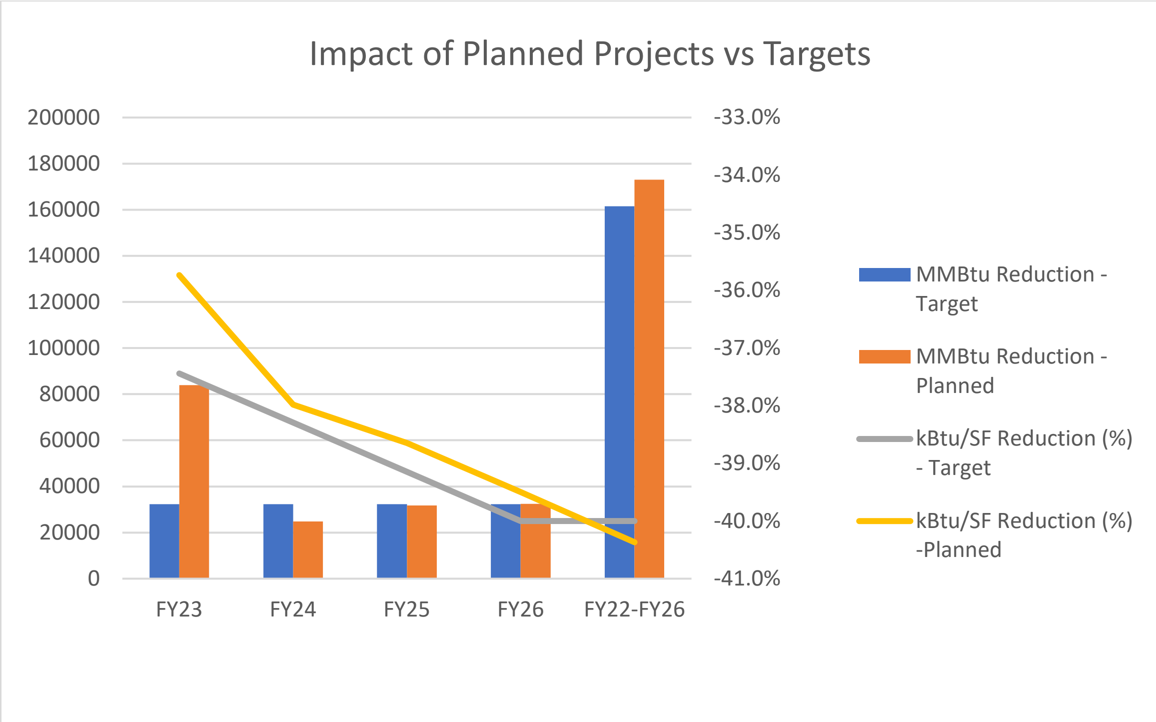
FY26 Projects

FY26	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
McGavran Greenburg - Heat Recovery Replacement	1972	26261	-53122	2,443,110,092	$703,600	Targeting FY25 1292 Funds
Genome Science RetroCx	1536.2	287542.1	689685.4	4,986,295,932	TBD	Targeting FY25 1292 Funds
Kenan Labs - Airflow Reduction (Lower Floor)	3364	335491	223506	5,880,187,071	TBD	Targeting FY25 1292 Funds
Koury Oral Health RetroCx	972.1	166608.3	8330.415	1,660,802,660	TBD	Targeting FY25 1292 Funds
Tarrson - Controls Upgrade	147	50027	110851	685,608,876	$1,170,000	Targeting FY25 1292 Funds
Energy Management Programs						
Building Optimization	4331	49144	1335844	10,308,544,931	NA	on going
LED Lighting Projects						
Admin Office Bldg			845559	2,885,047,308	$200,000	Targeting FY25 1292 Funds
EHS			156366	533,520,792	$19,600	Targeting FY25 1292 Funds
MBRB			728791	2,486,634,892	$102,200	Targeting FY25 1292 Funds
New East			189314	645,939,368	$26,500	Targeting FY25 1292 Funds
				32,515,691,921	$2,221,900	
Notes						
1. Project scope and cost estimates to be further developed during FY24.						

Conclusions

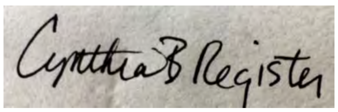
The Strategic Energy & Water Plan is a working document designed to provide guidance in reaching the University's goals for reduced energy use intensity and water use intensity. The plan is designed to be easily updated and flexible so that initiatives can be modified in response to changes in the University's capital program and in response to changes to operations on the University campus.

With the current and future planned projects/initiatives identified in this plan, UNCCH will be close to achieving the 40% goal for FY25. UNCCH Energy Management is continuing to develop projects/initiatives and to seek funding approval as required to implement. In addition, UNCCH Energy Management is continuing its on-going monitoring and retro-commissioning efforts in-house to maximize low cost opportunities for energy and water savings. The savings results of these efforts will be captured in each annual update of the Plan. The graph below illustrates the impact of planned projects identified in the previous tables.


Impact of Planned Projects vs Targets
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
-33.0%
-34.0%
-35.0%
-36.0%
-37.0%
-38.0%
-39.0%
-40.0%
-41.0%
FY23
FY24
FY25
FY26
FY22-FY26
MMBtu Reduction - Target
MMBtu Reduction - Planned
kBtu/SF Reduction (%) - Target
kBtu/SF Reduction (%) -Planned

Energy Mandate

I have read the Strategic Energy and Water Plan for the organization. The plan, as presented, supports the reductions required in Session Law 546.



Cynthia Register

Executive Director of Engineering Services

Anna Wu, FAIA

Associate Vice Chancellor of Facilities Services

UNIVERSITY OF NORTH CAROLINA
CHARLOTTE

Strategic

Energy Plan

2022 UPDATE

August, 2022

Contents

Strategic Energy Plan

Executive Summary

Campus Energy Overview

Size and Growth

UNC Charlotte is an urban research-intensive university, located primarily on a 1,000-acre campus in the state's largest city. In the Summer of 2022, the University had a campus community (students, faculty, and staff) of approximately 33,300 with nearly ten (9.97) million gross square feet (GSF) of built space, including parking decks. Plans continue for an enrollment increase to approximately 35,000 students in the next (5) years. Additional Academic / Research, Auxiliary Services and Residence Life space continue to be built to support campus population growth.

Since 2003, the full time equivalent (FTE) Faculty / Staff campus population has grown to 3,700 and built space has more than doubled. In that same period, energy consumption has grown by 53%, and energy costs have grown by 88%; however, energy consumption per GSF has fallen by 35%. Although, the university strives to reduce energy consumption in campus facilities 2022 may not be indicative of actual performance due to operation increases associated with full operations post COVID-19.

Energy Systems

Building heating and cooling requirements are provided by a combination of Regional Utility Plants (RUPs) and HVAC systems dedicated to specific buildings. Regional Utility Plants are designed and constructed to provide energy efficient distribution of chilled water and hot water to multiple buildings. The new RUP5 is now up and running, supporting the core campus buildings that used the Main Plant Steam and the new Science building is up and running.

The majority of main campus is primarily served by a single electrical substation. Given the emerging potential for energy conservation, the university may be able to meet future growth with its current electrical substation, thus saving substantial infrastructure costs and land. One emerging challenge could be to meet electricity demand if electrification of current natural gas-fueled equipment is pursued to meet climate goals and/or required in modernized building codes.

Energy Conservation Challenges, Accomplishments and Goals

Accomplishments and Goals

UNC Charlotte's energy use reduction of 35% per building GSF provided an avoided cost of approximately $5.5 million this year alone over the 2003 baseline. New buildings continue to have energy recovery and high efficiency equipment / systems installed. As noted previously these results may not be indicative of actual performance due to operational increases associated with full operations post COVID-19.

Funded through a combination of Performance Contracting, Operational and Repair and Renovation funds, significant energy reduction will continue through:

- Energy Audits
- Tuning of buildings to actual requirements versus design assumptions
- System retrofit modifications such as high efficiency motors, VFDs, LED lighting
- HVAC scheduling for occupancy
- Awareness training

The University is now in Year 8 of its "Guaranteed Energy Savings Performance Contract" w/ Year 7 M&V verifying $64,981 and Year 8 M&V non-verified $61,795 in excess savings. The "Performance Contracts" through Ameresco and JCI (UNC – Gen. Admin. Lighting) continue to provide energy savings through the energy related capital improvements to roughly twenty-eight (28) different campus facilities.

Web based monitoring continues to be provided on all new buildings and on existing buildings undergoing major renovations. State-of-the-art DDC Control Systems with utility monitoring and trending are also used.

Retro-Commissioning and building energy audits continue to be a priority as funding becomes available. Retro-Commissioning will be prioritized at the RUP facilities and will be performed at other facilities only after ASHRAE Level II energy audits have been completed on the facility.

The University continues to add utility monitoring to existing buildings that do not have active water, electricity, chilled or hot water BTU meters and natural gas pulse units. Older meters are being replaced with new meters that have the capability to communicate to the existing Building Automation System (BAS), which allows trending and archiving of energy usage data. Keeping the BAS and existing energy meters on campus operational and properly communicating is an ever increasing (on-going) challenge as well.

North Carolina G.S. 143-64.12 and LEED principles for sustainability, particularly relating to energy and water use, are included in the UNC Charlotte Design and Construction Manual. UNC Charlotte has (11) certified green buildings to date (5 LEED, 6 Green Globes) and is currently pursuing Green Globes certification for the new Science Building and Phase XVI Housing. Since the first campus building was certified under LEED in 2009, UNC Charlotte has certified construction and design on 71% of eligible construction based on occupied gross square feet. With smaller buildings that are not certified, the university continues to emphasize energy and water efficiency standards detailed in the Design and Construction Manual. Updates to the manual were formally adopted in 2018-19 in areas of lighting, lighting controls, insulation, solar thermal heating systems, plumbing fixtures and construction/demolition waste diversion to align with ASHRAE 189.1 (2014) *Standard for the Design of High-Performance Buildings* and ASHRAE 90.1 (2016) *Energy Standard for Buildings*. Starting in 2020, the university has maintained a Gold-level membership in the US Green Building Council to make over 900 online courses available free to staff, faculty and students.

To gain an external comparison, UNC Charlotte participated in the USEPA Energy Star Higher Education Benchmarking Initiative. Energy data for the Main Campus for calendar year 2019 was submitted to EPA. A scorecard report was generated by EPA to compare UNC Charlotte to different institutional peer groups (from 187 participating campuses) in terms of energy use intensity (EUI). UNC Charlotte Main Campus EUI ranked: 60 out of 67 for campuses with central heating plants; 14 of 18 for campuses with 50-99 buildings; 21 of 25 for campuses with 7-12% Energy Intensive floor space; 18 of 20 for campuses in Climate Zone 3; 12 of 19 for campuses with 20-29% resident students; 20 of 24 for campuses with $90M-$700M endowments; and 3 of 4 for Carnegie classification Doctoral/Professional. In summary, UNC Charlotte's Main Campus EUI was higher than the median in every comparison group the EPA could assemble. This report challenges us to consider whether university and state standards, goals, and investments for energy conservation are too modest.

Strategic Energy Plan

Energy Plan

UNC Charlotte's energy plan is structured into five 5 areas in order to accomplish specific goals in each of the categories below.

Energy Data Management – UNC Charlotte has a program for collecting and analyzing monthly utility billing information using spreadsheets. The main campus electrical substation is trended real-time to document high consumption periods. UNC Charlotte is beginning to compare energy usage in similar building types by usage, i.e. library, classroom building, research building, etc.

Energy Supply Management – UNC Charlotte is proactive in selection of electrical rates and cost-effective fuel rates for Regional Utility Plants. Energy supply management must also demonstrate choices that achieve the campus and UNC System goals to be carbon neutral by 2050, the state goal of 40% reduction in greenhouse gas emissions by 2025, and the City of Charlotte's Strategic Energy Plan for reducing greenhouse gas emissions per capita by 80% by 2050. Facilities Management thoroughly reviews utility invoices for deviations indicating billing errors.

Energy Use in Facilities – Building HVAC and lighting controls are updated as renovations occur or as Retro-Commissioning takes place. New buildings have state-of-the-art Building Automation System (BAS) controls. New and existing building control systems will be evaluated and adjusted for optimum energy usage.

Equipment Efficiency – UNC Charlotte requires all equipment replacements to meet or exceed code requirements. Preventive Maintenance is in effect. Major energy consuming equipment will be identified and evaluated for cost-effective modification or replacement. All chillers were selected on Life Cycle Cost Analysis.

The Utility Carry Forward funds have historically been used for Retro-Cx of campus buildings and fixing small equipment issues found by the Retro-Cx to improve the building energy efficiency. Larger and more capital intense equipment is normally funded through R&R capital projects. In FY-22, the Utility Carry Forwards funds are expected to fund ASHRAE Level II Energy Audits on campus and fixing energy issues found by these audits.

Organization Integration & Awareness Training – The Energy Manager will continue to work closely with the University Sustainability Officer for various energy conservation measures and training efforts within the appropriate University departments. The Sustainability Office priorities as of 2018 are to pursue compliance with the UNC Sustainability Policy (600.6.1). Energy management is recognized in the sustainability plan as under a category of "Operational Priority" with an expectation for continuous improvement. The Energy Manager will also contribute to a 5-year initiative on "Responsible Purchasing" that includes improving policies and practices regarding procurement of energy and technologies. In response to Sustainability being apart of the Chancellors strategic plan the Chancellor's Executive Sustainability Committee is drafting a Sustainable Facilities Policy that may include building standards, temperature policy, and purchasing of energy and water consuming equipment. Additional training of maintenance staff is being performed in order to educate staff on building operational efficiency. These efforts are aimed at improving behavior and awareness in ways that

Strategic Energy Plan

contribute to the University's continued ability to exceed the state of North Carolina mandated conservation goals.

Past Year Accomplishments	Measurement	Savings Estimated	Cost	Funding Source	Area
Continue maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Continue to monitor all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM	Energy Data Management
Continue firm & interruptible transportation of nat. gas w/ well head pricing for RUP's.	$ per month	$234k	N/A	FM	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM	Energy Supply Management
ASHRAE Level II Energy Audits will be conducted by FM in conjunction with university faculty at ten (10) university buildings.	kWh, Therms	TBD	$47k	Utility Carry Forward	Energy Use in Facilities
Implement ten (10) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$171k	$59k	Utility Carry Forward / FM	Energy Use in Facilities
Develop Energy Efficiency Goals for BAS technicians & Train to Identify	kWh, Therms	$227k	$26k	Utility Carry Forward	Organization Integration & Awareness Training
Develop a UNCC FM Energy Management web page.	Web Page Developed	N/A	N/A	FM	Organization Integration & Awareness Training

Strategic Energy Plan

Planned Activities 2022-2023	Measurement	Savings Estimated	Cost	Funding Source	Area
Continue maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Continue to monitor all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM	Energy Data Management
Continue firm & interruptible transportation of nat. gas w/ well head pricing for RUP's.	$ per month	$234k	N/A	FM	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM	Energy Supply Management
Energy Audits will be conducted by FM in conjunction with university faculty at ten (10) university buildings.	kWh, Therms	TBD	$47k	Utility Carry Forward	Energy Use in Facilities
Implement ten (10) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$150k	$150k	Utility Carry Forward / FM	Energy Use in Facilities
Develop/Implement HW/CHW optimization Strategy	Develop/ Implement in 5 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
Implement Economizer Control, Supply Air Temp, & Demand Based Reset Strategies	Implement in 5 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
RUP2 VFD Replacement	kWh, Therms	$11,040	$45k	FM	Equipment Efficiency
McEniry Hall Chiller Replacement	kWh	TBD	TBD	FM	Equipment Efficiency
Energy Efficiency Goals for BAS technicians	kWh, Therms	TBD	TBD	FM	Organization Integration & Awareness Training
Develop Periodic Communications to FM and the Campus regarding Energy Efficiency	Published	N/A	N/A	FM	Organization Integration & Awareness Training
Continue to follow Temperature Control Policy within Administrative Facilities	Implement	TBD	TBD	FM	Organization Integration & Awareness Training
Reclaimed Water System Water Quality Instrumentation (includes academic access to data)	Sensors purchased	N/A	$35,00 0	Student green fund	Organization Integration & Awareness Training
Grants to depts for upgrade costs for 6 EnergyStar ultralow freezers for new Science Building	kWh	$18,000	$12,00 0	Student green fund	Organization Integration & Awareness Training
Re-launch of Green Office Program to expand/update energy conservation tips	Office units certified	N/A	$3,000	Sustainability Budget	Organization Integration & Awareness Training
University Policy for Sustainable Facilities (includes energy and water conservation)	Submission to Chancellor	N/A	N/A	Sustainability Budget	Organization Integration & Awareness Training

Strategic Energy Plan

Appendices

A. G.S. 143-64.12(a) Declaration

B. SEO Annual Report Form FY '22 (Attachment)

Strategic Energy

UNIVERSITY OF NORTH CAROLINA
CHARLOTTE

Appendix A

(To be updated at later date)

I have read the Strategic Energy Plan for my Organization. The plan, as presented, supports the reductions required in G.S. 143-64.12(a).

Implemented this _1st_ day of August, 2022

Jason Bernstein, PE, CEM, SFP
Energy Manager – Engineering

Don Janus
Director of Engineering

- **See signed attached pdf.**

UNC GREENSBORO
Facilities Operations

2022 Strategic

Energy and Water Annual Report

July 28, 2022
Facilities Operations
Prepared by: Nihal Raees

UNC Greensboro South Chiller Plant September 2020

I. OVERVIEW

The University of North Carolina at Greensboro (UNCG) is continuing to reduce its energy footprint by using all available resources for more energy efficiency on campus while supporting the University's missions. Through the 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, UNCG energy, and water consumption have decreased significantly since the baseline year FY2002-2003 designated by the State. This report provides a top-level description of the campus utility 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 changes in student counts and campus building square footage. UNCG is currently at 95,179 EUI BTU/GSF, achieving a 24% EUI reduction from 125,963 EUI in the baseline year of 2003. Full-Time Equivalent (FTE) student enrollment has declined during and post-pandemic. The fall of 2021 showed 17,025 FTE, a 5% enrollment decline from the prior fall and a 38% increase from 12,000 FTE in the 2003 baseline year. For 2022, the campus footprint on the other hand stayed flat to the prior year, holding a 58% area increase of 2.5 million GSF of additional indoor spaces over the 2003 baseline area.

II. SUMMARY OF THE FISCAL YEAR 2021-22:

Utility expenditures for the University were $ 8.87 million (Electricity: $ 4.70 million for 78.54 million kWh; Natural Gas: $ 2.71 million for 3.61 million therms; Water: $ 1.23 million for 116.6 million gallons of water; and $ 240 thousand for 88.7 kgal of #2 fuel oil. FY2022 utility costs showed a 16% higher expenditures or $1.21 million dollars difference to the prior 2021 fiscal year.

In FY2022, the University used approximately $981,000 of Utility Savings Carry Forward HB 1292 (USCF) funds for different projects on campus to improve efficiency and to back up Repairs & Renovation (R&R) funds when needed. To cut costs and time, Facilities Operations managed all the projects in-house:

Steam Plant Activities:

- Boiler #4 Economizer $145,717: a new more efficient airside economizer replaced the original 2005 one that was leaking for a couple of years causing plug one of the 6-passes were leaks the most.
- Boiler #1 Feedwater Pump $51,246: the project upgraded an obsolete horizontal 75 horsepower (HP) pump with a new vertical Grundfos 30 horsepower HP and installed a variable frequency drive VFD. This project was left on from the previous project for Boiler #2 & #3 Feedwater pumps due to insufficient funds.
- Steam System infrastructure $197,740: inspected steam and condensate piping conditions for the area between MH #11 to MH #12 and added ventilation.

HVAC Shop Activities

- Cooling Tower Fan Motors $12,994: replaced (2) two old failing 100 HP motors each with new NEMA Premium Efficient ones in McIver Chiller Plant with a 6,000-cooling ton capacity.
- New mini-split cooling units $27,477: for ITS Information Technology rooms to maintain equipment requirements at lower down to 68-72 F cooling temperature. This approach would not only help maintain ITS pieces of equipment but also reduces the additional cooling loads at the related air handler unit throughout the day and when set on unoccupied mode. HVAC personnel installed in-house all the (4) four purchased mini-split units each in the assigned building.

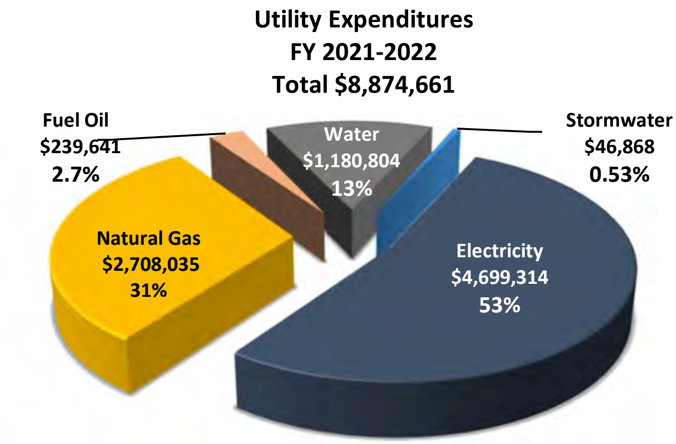
- New Temperature and Humidity sensors for Weatherspoon Cone Art Building $42,381: replaced and relocated the existing temperature and humidity sensors for the galleries for more thermal enhancement to the museum facility.
- Repair various air handling units on campus for $65,883: replaced faulty return and or outdoor dampers, actuators, and linkages.
- Outdated HVAC systems' Air Compressor Replacements:
  - Sullivan Science Building $61,025: upgrade an old scroll open system compressor (6-motors 5 HP each) with a NEMA 30 HP oil-free rotary screw air compressor. The compressor serves teaching labs & nuclear magnetic resonance room.
  - Eberhart Building $10,812: replaced an old obsolete 4 HP compressor with a new Duplex Mounted & Dryer NEMA 1 Control & magnetic motor starters.
- Outdated Boiler Replacements:
  - Becher-Weaver Building heating boiler $74,477: replaced with a new more efficient one. The new boiler was downsized to 1.8 million BTU/hr two-thirds of the original design of 2.52 million BTU/hr to serve the entire building. The new boiler serves only the warehouse portion, leaving (9) heating/cooling rooftop units taking care of the office area.
  - Chemical Safety Building heating boiler $19,788: replaced with a new more efficient one matching the original outdated 23-year-old heating boiler.

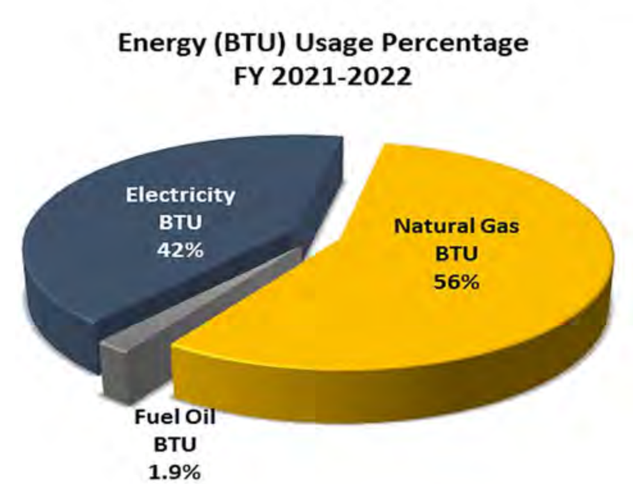
- <u>Electric Shop and Buildings and Trades LED Upgrade on campus</u>: on top of continuous efforts to upgrade T12, metal halide, and incandescent lamps on campus to LED, USCF funds used for larger-scale LED upgrade projects on campus:
  - Curry Building (everywhere except for the Auditorium) $20,009: over 2,300 lamps of T12 and incandescent were converted into LED in an in-house upgrade project.
  - Moran Commons Fountain Steps $26,759: in-house project converted fluorescent into LED.
  - School of Education stairwell fixtures $31,955: converted wall-mounted compact fluorescent with battery pack ballast into line-voltage LED fixtures in an in-house project.
  - Jackson Library Chiller Plant $1,417: in-house project converted high-bay 400-watt high-pressure sodium fixtures into LED.
  - Campus-wide outdoor LED $49,003: UNCG contracted out LED installation work for 368 outdoor lighting poles. The work converted high-pressure sodium lamps to line-voltage bypassing LED. The project finished Phase 5 through 10 of the original 10-phase in-house Campus Outdoor Poles Green Fund plan. The student-supported Green Fund paid for Phases 1 through 4.
  - UNCG contracted out an LED upgrade using a leftover from the previous year's USCF capital project to upgrade the lighting in two buildings for $98,900: An auditorium room in Curry Building, and two gymnasium rooms in the 1510 Walker Ave Building houses Guilford County Schools' Middle College at UNCG.

III. UTILITY USAGE

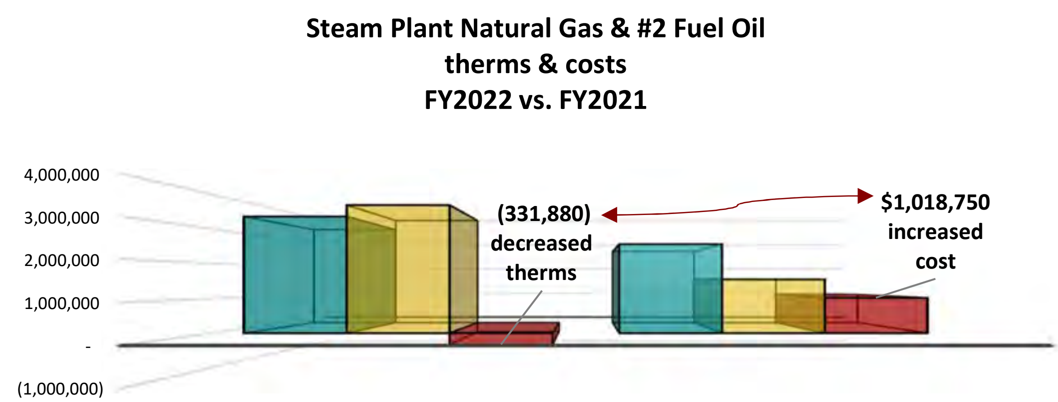
UNC Greensboro currently stands at 95,179 BTU/GSF overall campus Energy Use Intensity (EUI), achieving over 24% EUI reduction to the FY2003 baseline year. Although UNCG has not met the 30% State-mandated EUI reduction goal from FY2015, the University dropped below the 107,939 BTU/GSF/year UNC System FY2021 level after starting at a lower baseline at 125,992 BTU/GSF/year in 2003.

FY2022 electricity, natural gas, and water total utility cost per campus square foot were 1.3 $/GSF, a flat change to the baseline year and a 16% increase from $1.1 in the prior year. Mentioning the prior year, FY2021 was the lowest key performance indicator (KPI) cost per unit area UNCG has registered since 2003.





The University electricity costs over the prior year have not changed much. Similarly, campus water usage has less than a half percent consumption increase, and only 8% expenditures increase over the prior year including a 4%-unit rate increase from the vendor. On the other energy side, however, the ongoing global natural gas crisis has directly affected Steam Plant therms usage and expenditures (over 85% of total campus natural gas consumption). The supply shortage crisis not only curtailed natural gas to the steam plant a couple of times through wintertime, but also significantly higher natural gas therm costs. In FY2022, UNCG Steam Plant had a 9% drop in consumption, yet still, natural gas and #2 fuel oil expenditures had 66% costs increase over FY2021.



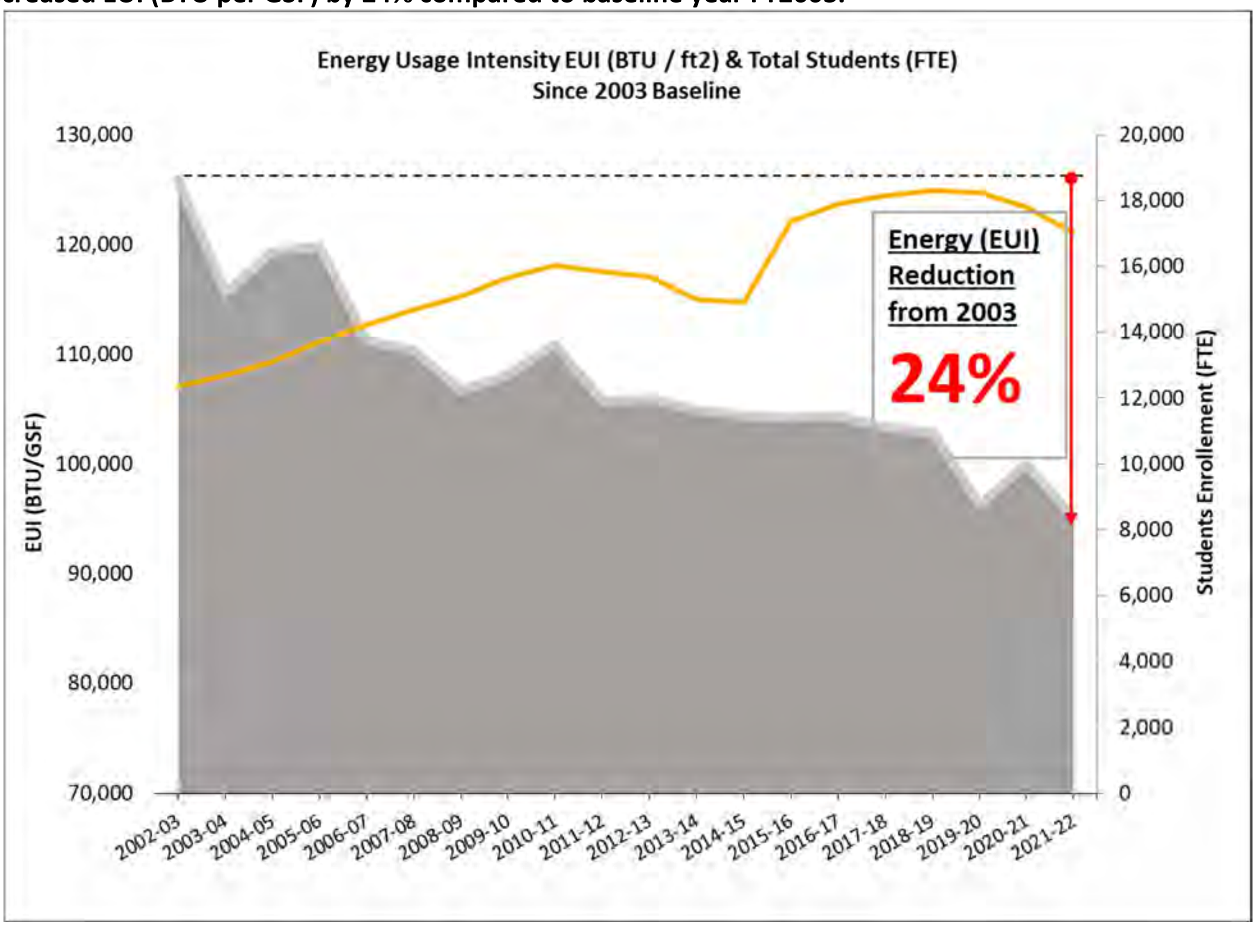
	therms	Cost
FY2022	3,350,347	$2,554,467
FY2021	3,682,227	$1,535,718
FY22 vs. FY21	(331,880)	$1,018,750

FY2022 Energy Usage Narrative:

- the newly constructed Nursing and Instructional Building (NIB), 186,004 GSF, came online in December 2020 served by campus utility loops (steam, chilled water, electricity, and domestic water) folded its full operational year with 1.67 million kWh for only at the building level.
- The newly constructed South Chiller Plant's 3,000-ton cooling capacity came online in September 2020. The new more efficient chiller plant is running at a full capacity as a baseload for campus cooling load supporting McIver Chiller Plant 6,000-ton capacity.
- UNCG Steam Plant had a significant natural gas reduction after fixing substantial condensate leaks in the campus steam and condensate underground distribution system in FY2021.
- National Weather Service showed Greensboro observed 3,122 Heating Degree Days (HDD) to 3,453 degrees in the prior year, 331 fewer degrees for a milder winter. On the cooling side and summertime, Greensboro and the campus observed 1,618 Cooling Degree Days as compared to 1,506 in the prior year with 112 additional degrees developing a warmer summer.

Despite the NIB's additional load, the University recorded the lowest ever EUI, 95,197 EUI BTU/GSF, a 5.6% reduction over FY2021, and a 24% reduction over the 2003 baseline year level.

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



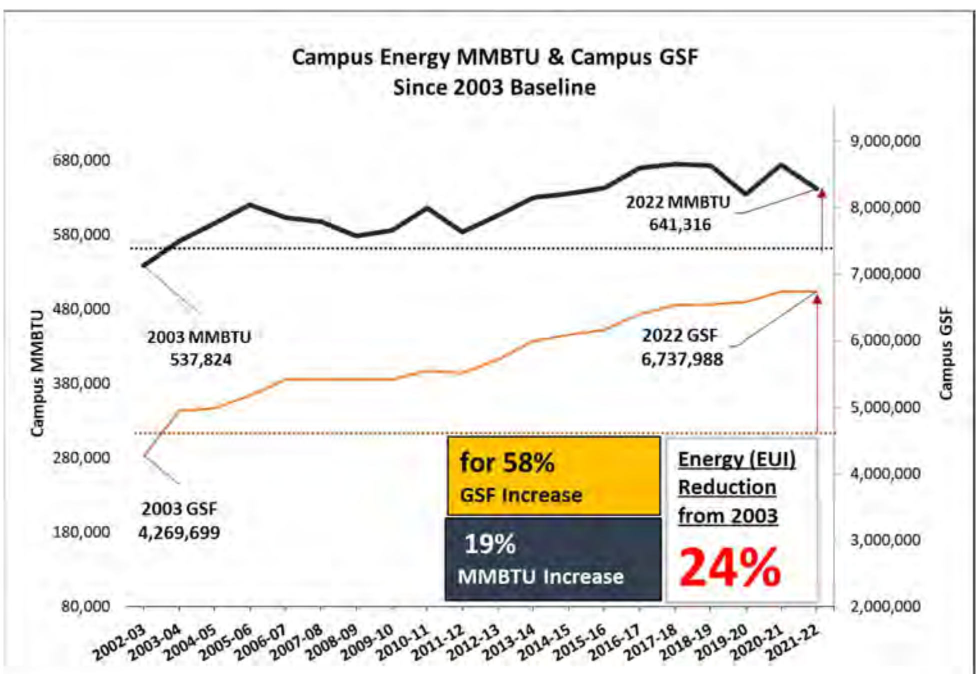
This fiscal year detailed the following utility consumption over the prior year: Electricity had 78,540,579 kWh; less than 1% increase = 764,347 kWh additional over the prior year's consumption. The University used 3,610,286 therms of over 10% reduction = 433,157 therms fewer than what have been used in the prior year (not including #2 fuel oil therms). UNCG Steam Plant under 405N - Natural Gas (Pipeline, Firm & Interruptible) mandatory statewide term contract had a couple of natural gas curtailments resulting in using $239,641 for purchasing 88,740 gallons #2 fuel oil.
On the water side, the campus used 116,586 kGal of water, a 0.5% increase = 599 additional kGal to the prior fiscal year. The campus water KPI is 17.3 Gallons/GSF showing a 78% reduction from the 2003 level, surpassing the UNCG System goal.

Since the baseline level in 2003, FY2022 showed the University has expanded by a 58% increase in campus buildings footprint with only a 19% increase in million BTU used for the operation to make it up to the 24% EUI reduction.

Fiscal Year	***Area***	***All Utilities***	***Utility/Area***	***Energy***	***Energy/Area***	***Energy***	***Energy Cost***
	GSF	***Cost $***	***$ / GSF***	***Cost $***	***$ / GSF***	***MMBTU***	***$ / MMBTU***
2002-03	**4,269,699**	**$5,537,461**	1.3	**$4,990,987**	**1.2**	**537,824**	**$9.3**
2003-04	4,942,520	$6,085,348	1.2	$5,527,654	**1.1**	571,384	$9.7
2004-05	4,987,544	$6,878,519	1.4	$6,248,603	**1.3**	594,916	$10.5
2005-06	5,177,689	$8,455,503	1.6	$7,622,474	**1.5**	620,424	$12.3
2006-07	5,415,496	$7,674,070	1.4	$6,884,414	**1.3**	602,349	$11.4
2007-08	5,415,496	$8,500,093	1.6	$7,593,983	**1.4**	597,302	$12.7
2008-09	5,415,496	$7,906,663	1.5	$6,861,603	**1.3**	577,867	$11.9
2009-10	5,415,496	$7,713,099	1.4	$6,530,241	**1.2**	585,475	$11.2
2010-11	5,551,245	$7,653,606	1.4	$6,753,156	**1.2**	615,587	$11.0
2011-12	5,510,548	$7,402,485	1.3	$6,663,983	**1.2**	582,985	$11.4
2012-13	5,716,735	$7,571,726	1.3	$6,853,774	**1.2**	605,897	$11.3
2013-14	5,999,437	$8,034,092	1.3	$7,234,731	**1.2**	629,295	$11.5
2014-15	6,086,061	$7,859,390	1.3	$6,959,803	**1.1**	635,534	$11.0
2015-16	6,163,784	$7,776,021	1.3	$6,783,434	**1.1**	642,376	$10.6
2016-17	6,408,406	$8,569,900	1.3	$7,435,123	**1.2**	668,955	$11.1
2017-18	6,531,155	$8,621,691	1.3	$7,521,794	**1.2**	674,606	$11.1
2018-19	6,542,163	$8,601,691	1.3	$7,435,361	**1.1**	672,766	$11.1
2019-20	6,586,747	$7,739,359	1.2	$6,554,646	**1.0**	634,193	$10.3
2020-21	6,737,988	$7,668,308	1.1	$6,536,559	**1.0**	673,406	$9.7
2021-22	**6,737,988**	**$8,874,661**	**1.3**	**$7,646,990**	**1.1**	**641,316**	**$11.9**
% Change to FY2021	0%	16%	16%	17%	17%	-5%	23%
% Change to 2003 Baseline	58%	60%	2%	53%	-3%	19%	28%

Key Performance Indicators (KPI).

Fiscal Year	*Area*	*Students*	*Total Energy*	*Energy Cost*	*Energy/Area*	*Energy/FTE*	*Water*	*Water/Area*	*Gallon/FTE*
	GSF	*Eq. FTE*	*MMBTU*	*$*	*EUI BTU/GSF*	*MMBTU/FTE*	*Gallons*	*Gal / GSF*	*Gal / FTE*
2002-03	**4,269,699**	**12,354**	**537,824**	**$4,990,987**	**125,963**	**44**	**336,408,512**	**79**	**27,231**
2003-04	4,942,520	12,708	571,384	$5,527,654	115,606	45	290,356,396	59	22,848
2004-05	4,987,544	13,099	594,916	$6,248,603	119,280	45	543,824,424	109	41,516
2005-06	5,177,689	13,723	620,424	$7,622,474	119,827	45	175,592,520	34	12,795
2006-07	5,415,496	14,219	602,349	$6,884,414	111,227	42	154,828,520	29	10,889
2007-08	5,415,496	14,704	597,302	$7,593,983	110,295	41	155,922,844	29	10,604
2008-09	5,415,496	15,097	577,867	$6,861,603	106,706	38	171,504,432	32	11,360
2009-10	5,415,496	15,670	585,475	$6,530,241	108,111	37	183,458,968	34	11,708
2010-11	5,551,245	16,036	615,587	$6,753,156	110,892	38	141,496,916	25	8,824
2011-12	5,510,548	15,841	582,985	$6,663,983	105,794	37	122,794,672	22	7,752
2012-13	5,716,735	15,683	605,897	$6,853,774	105,987	39	130,566,923	23	8,325
2013-14	5,999,437	15,009	629,295	$7,234,731	104,892	42	123,906,620	21	8,256
2014-15	6,086,061	14,915	635,534	$6,959,803	104,424	43	126,757,984	21	8,499
2015-16	6,163,784	17,365	642,376	$6,783,434	104,218	37	133,052,004	22	7,662
2016-17	6,408,406	17,891	668,955	$7,435,123	104,387	37	143,057,700	22	7,996
2017-18	6,531,155	18,153	674,606	$7,521,794	103,290	37	132,712,640	20	7,311
2018-19	6,542,163	18,303	672,766	$7,435,361	102,835	37	131,447,729	20	7,182
2019-20	6,586,747	18,249	634,193	$6,554,646	96,283	35	130,134,944	20	7,131
2020-21	6,737,988	17,811	673,406	$6,536,559	99,942	38	115,987,304	17	6,512
2021-22	6,737,988	17,025	641,316	$7,646,990	95,179	38	116,586,312	17	6,848
% Change from 2021	0%	-4%	-5%	17%	-5%	0%	1%	1%	5%
% Change to 2003 Baseline	58%	38%	19%	53%	-24%	-13%	-65%	-78%	-75%



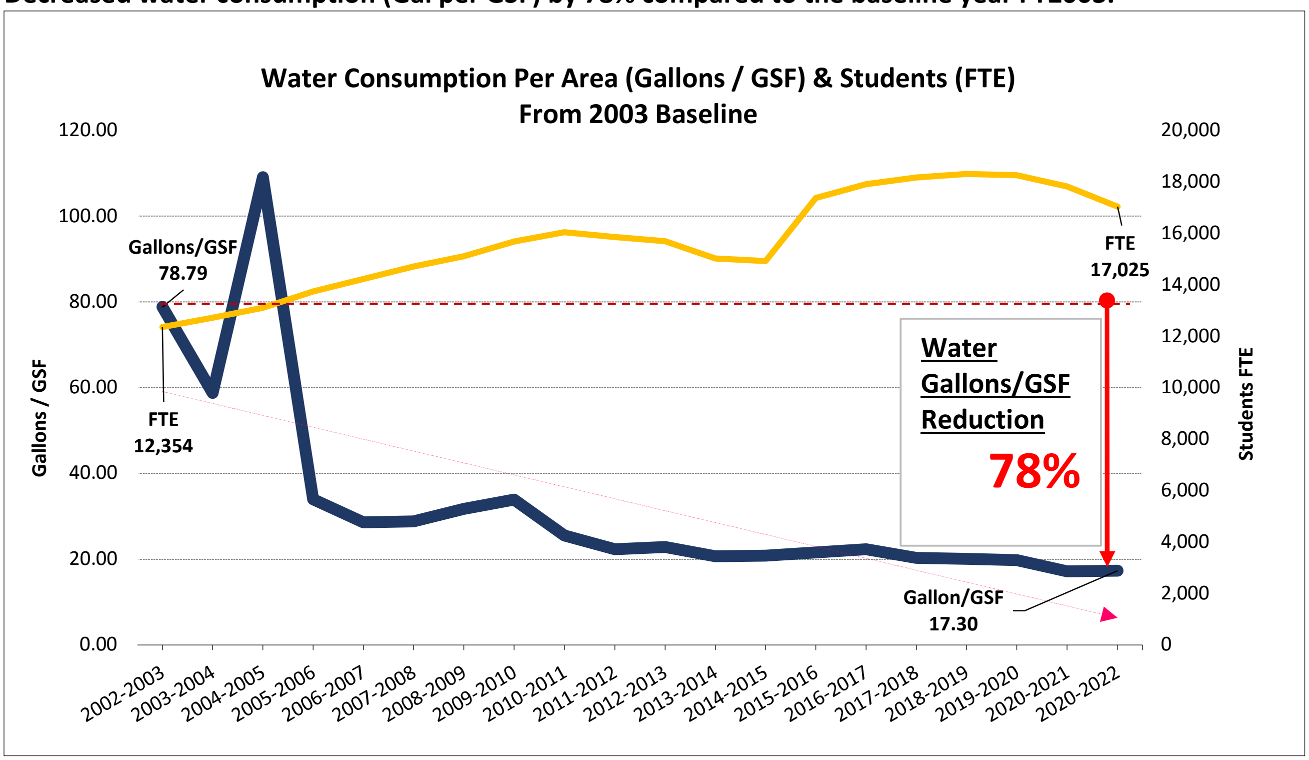
IV. BASELINE & UTILITY OVERVIEW

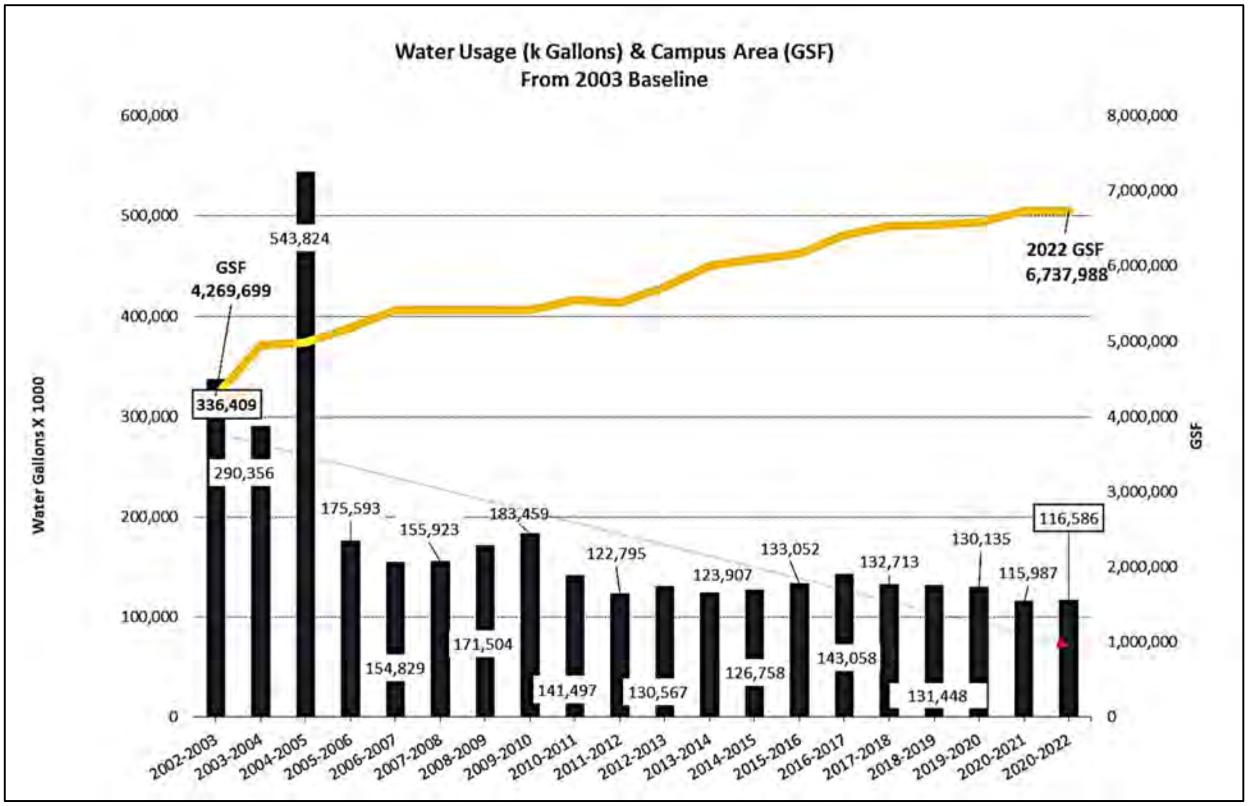
- WATER

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 Water Resources Department.

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 78% reduction in water consumption (per GSF) since the baseline year, FY2003, and a half percent 0.52% increase when compared to the prior fiscal year 2021.

Decreased water consumption (Gal per GSF) by 78% compared to the baseline year FY2003.



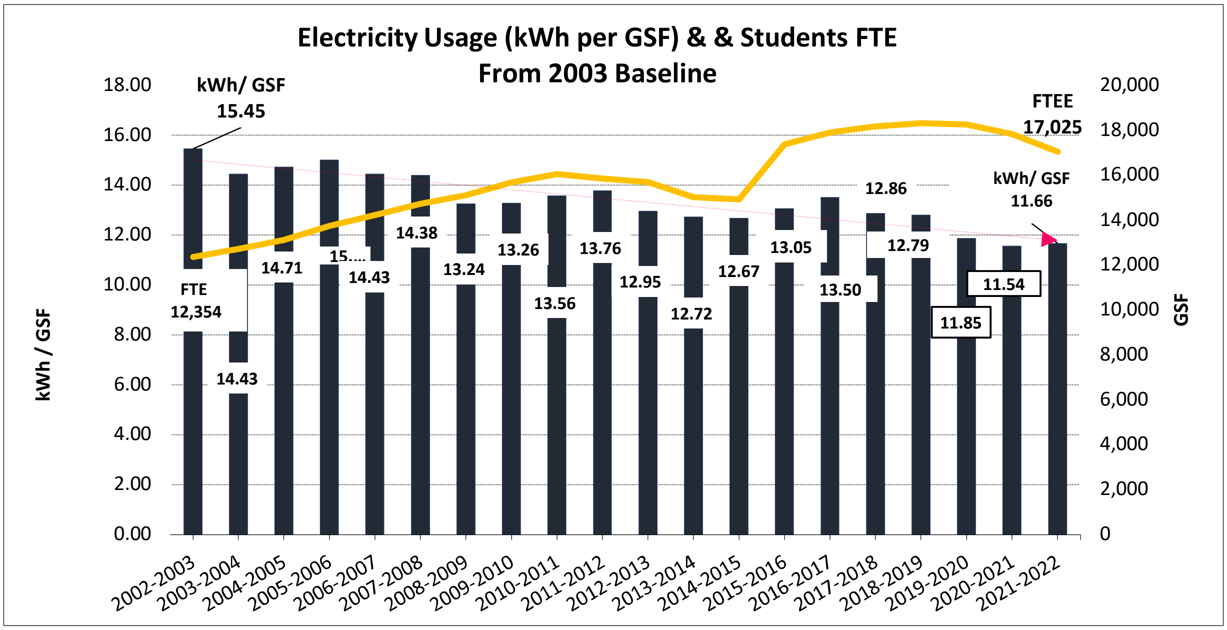


- **ENERGY (ELECTRICITY, NATURAL GAS, AND #2 FUEL OIL)**

- **ELECTRICITY**

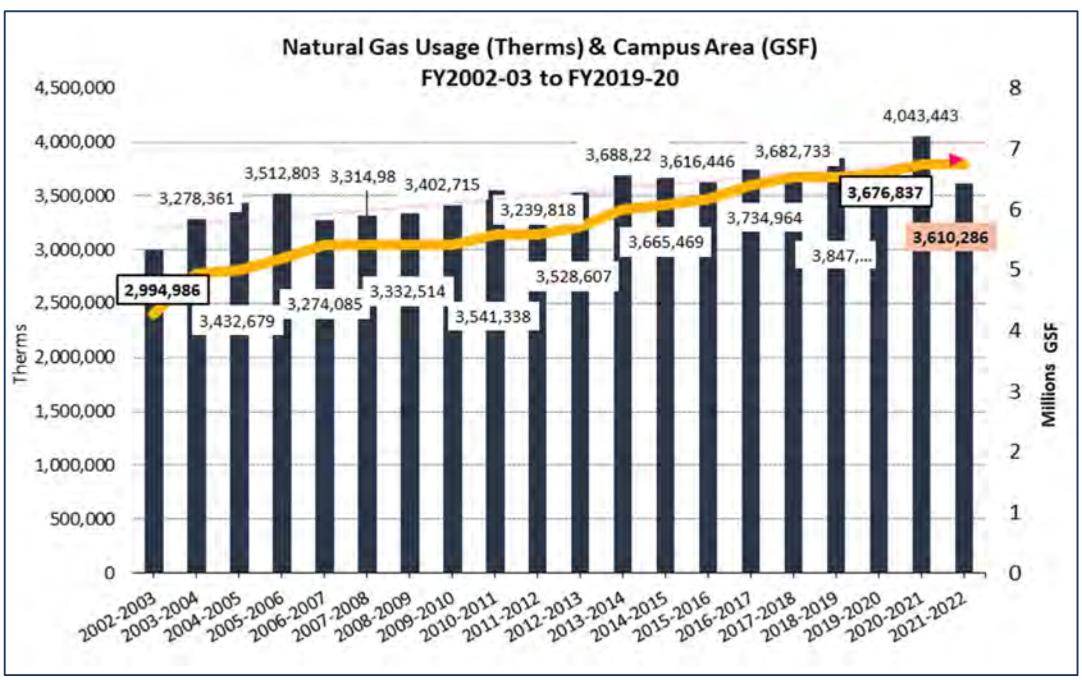
Duke Energy provides electric power to UNCG facilities through over a hundred accounts. By far the largest account is the main campus substation that feeds an underground medium voltage electrical distribution system connected to more than 60 buildings. The campus substation is on a time-of-use electricity 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 FY2022, the University's total electricity bill was $4.7 million for 78.54 million kWhs, reflecting 11.66 kWh per GSF in electricity KPI, and 4,613 kWhs per FTE student**.** FY2022 showed less than a 1% increase to 11.54 kWh/GSF in FY2021 and a 25% reduction to 15.45 kWh/GSF baseline year KPI.



Natural Gas: The Steam Plant's Natural Gas 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 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 FY2022, the total natural gas expenditures were $2.71 million for 3.61 million therms reflecting over a 10% decrease of approximately 433,000 fewer therms compared to FY2021, and a 21% actual therms increase over the baseline year. FY2022 Natural gas's KPI (BTU/GSF) recorded 53,581, showing a 10% decrease over the last year and a 24% decrease to 70,145 BTU/GSF in FY2003. Natural gas energy per student is 21.21 MMBTU/FTE, which shows a 7% decrease compared to FY2021 and a 13% decrease from the baseline KPI.



No. 2 Fuel Oil: The 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. In FY2022, UNCG used over 88,740 gallons of No. 2 fuel oil at the Steam Plant for a couple of curtailments in winter 2021-22.

- STEAM AND CHILLED WATER

The University uses purchased power and natural gas to create chilled water and steam that are distributed to the campus. 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. Facilities Operations uses an assigned building's gross square footage to allocate the total steam and chilled water cost for each entity.

Steam: Steam is piped to 63 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 including the newly constructed Nursing and Instructional Building NIB.
UNCG used 1292 carry forward funds to maintain and improve the steam plant performance. In FY2020, new boiler controls were installed to replace outdated ones with a new burner management system and master controller. In FY2022, Boiler #4 Economizer was replaced with a new, and Boiler #1 feedwater pump was downsized and added a new variable frequency drive VFD to optimize performance.

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. Using renovation and repair funds, the University replaced three different sections over the years so far. In the Summer of 2019, the Phase-4 section of manholes #73 to #74 EUC to Bryan Building Service Drive at Theta Street project was completed. The project replaced steam and condensate pipes, manhole refurbishment, and site work in Part-A between the Elliott University Center and Sterling St. Funds however were not available to complete Part-B between Sterling St. and the Bryan Building. UNCG plans to continue on Phase-4 Part B section as funds are available.

In the current Campus Master Plan recently updated by Affiliated Engineers and Sasaki, UNCG has included five (5) high-priority steam projects of a $3.9 million estimated cost to replace and renew critical portions of the steam distribution system.

In Summer 2020, a couple of condensate leaks were identified. After a large 5.1 magnitude earthquake hit North Carolina in August 2020, those leaks got worse affected by ground movement and a total of five leaks were identified. FY2021 carry forward funds were used to fix 5 of the leaks (1) Steam Plant-backside, (2&3) Theta Street leaks, (4) manhole MH55 Steam Tunnel, and (5) MH 85 by the EUC. Another suspected leak was exposed in FY 2022 from Manhole 11 to 12 South College Ave. The underground piping work showed no leaks to be concerned about in this section.

UNCG Steam Plant, including the NIB building, serves over 2.2 million assigned GSF (Assigned GSF =~60% of total GSF). In FY2022 the Plant produced 273.75 million pounds of steam. The steam mount shows an 8% decrease = 23 million fewer pounds for a 10% milder winter = 331 fewer HDDs over FY2021. Steam makeup water was 4.77 million gallons, a 39% decrease = 3.1 million fewer gallons of water used subsequent to fixing the various condensate leaks. The steam production energy and water consumption and costs can be furtherly controlled if UNCG has the funds to move forward with replacing the critical portions of the steam and condensate distribution system.

<u>Chilled Water:</u> UNCG McIver Chiller Plant (4 chillers 6,000-ton total capacity) and South Chiller Plant (2 chillers 3,000-ton current capacity) produce chilled water to serve HVAC needs in 43 buildings including the newly constructed NIB facility. The two chiller plants both serve over 1.5 million assigned GSF including NIB and Ragsdale Mendenhall Residence Hall which were recently (2019) connected to the campus chilled water loop.

- ENERGY DATA MANAGEMENT & BAS

UNCG collects energy consumption and billing information on a monthly basis for all buildings and facilities not served directly by utility companies. Currently, meters are still read manually, and the data is 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 Niagara AX JACEs Building Automation System (BAS). In FY2021, when Tridium alert stop supporting Niagara AX Supervisor licenses, UNCG contracted with Schneider Electric to migrate Niagara AX to Niagara 4 licensing model to maintain Tridium BAS on campus.

V. SUSTAINABILITY & ENERGY

UNCG received a STARS Silver rating in recognition of its sustainability achievements from the Association for the Advancement of Sustainability in Higher Education (AASHE). STARS, the Sustainability Tracking, Assessment & Rating System measures and encourages sustainability in all aspects of higher education.

- In FY21, UNCG's carbon footprint declined by 25% since 2009. Overall, the largest declines can be attributed to reductions in fossil fuel energy production by our utility provider, Duke Energy; the reduced occupancy of campus, and the related declines in business travel and student commuting due to the COVID-19 pandemic; and Facilities energy efficiency initiatives. Facilities has achieved a 33% reduction in emissions from purchased electricity since 2009, which accounts for 50% of total reductions in tons of CO2 since 2009 or 13% of UNCG's overall 25% reduction in emissions.
- UNCG earned Tree Campus Higher Education® recognition for the 13th year in a row. To obtain this distinction, UNCG met the five core standards for sustainable campus forestry required by Tree Campus USA, an Arbor Day Foundation program, including the establishment of a tree advisory committee, evidence of a campus tree-care plan, dedicated annual expenditures for its campus tree program, an Earth Day observance, and the sponsorship of student service-learning projects.
- The UNCG Green Fund has awarded $463,800 to 76 projects during its 7 years of existence to support sustainability initiatives on campus. In FY22, the Green Fund awarded a one-year record of 16 grants, totaling $77,557 for an average of $4,847 per grant. Facilities-related projects in FY22 included:

    - $3,032 to purchase 288 LED bulbs to upgrade the emergency lighting in Moore Strong, Winfield, and Ragsdale Mendenhall residence halls.
    - $5,760 to convert approximately fifty-three exterior lighting fixtures to LEDs.
    - $3,327 to purchase 550 LED bulbs to upgrade the emergency lighting in Reynolds, Grogan, and Cone residence halls.
    - $1,866 to purchase a new water bottle refill station in the Curry Building.
    - $2,104 to purchase a new water bottle refill station in the Moran Commons.
    - $5,544 to purchase 550 LED bulbs to upgrade the emergency lighting in McCormick and Lexington residence halls.
    - $3,752 to pay student labor to conduct a pilot study on the impact glass buildings on campus have on the local bird population.

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 the main resource to support energy-saving projects.

UNCG had only one energy savings contract (ESCO), a $7.2 million performance contract in 2008. UNCG started reporting/requesting the USCF credits in FY2011. The funds in 2012 were around $232,000 since the guaranteed energy savings contract pre-dated the HB 1292 legislation. All the way to FY2018, the approved/executed funds stayed below half a million dollars. Starting in FY2019, the funds continued to increase at a faster pace to be $981,009 in FY2022, and $1,065,902 requested to carry forward to FY2023. In this regard and to best use this program, UNCG plans ahead in a responsible stewardship manner to spend the entire USCF amount before it disappears by the end of the fiscal year.

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 and decarbonization 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.

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
USCF Fund	$262,785	$318,068	$316,585	$414,587	$714,806	$788,574	$872,169	$981,009	$1,065,902

VII. UNCG ENERGY MANAGEMENT

UNC Greensboro's energy management group consists of an Energy Team and an Energy Committee working together to closely monitor campus energy performance, identify anomalies, implement energy-related projects, and recognize gaps for improvements to achieve the University's energy and sustainability goals while supporting education and research requirements.

The Energy Committee is led by the Vice Chancellor for Facilities, the Director of Facilities Operations, the Sustainability Office, and the Energy Team. The Energy Team includes the Campus Mechanical Engineer, the Energy Analyst, the Utilities Manager, and Electric and HVAC Shop Supervisors. The Energy Team is the working group that operates and maintains campus facilities, implements projects, tracks performance, identifies anomalies and areas of improvement, and provides recommendations to the committee. The group meets on a monthly basis to review and monitor campus energy performance and establish plans to improve campus infrastructure and progress toward goals.

The University as part of the UNC System supports Executive Order 80 (EO80) and participates in the Utility Savings Carry Forward program G.S. §143-64.12 (USCF). For UNC Greensboro, USCF funds are the main source to improve campus energy and implement conservation measures. In this regard, the Energy group responsibly manages the funds to best serve the energy goals and maintain systems on campus.

On an annual basis, members of the Energy group attend State Energy Conference, Appalachian Energy Summit, and NC APPA conference. Both the Campus Mechanical Engineer and the Energy Analyst have completed Energy Management Diploma and obtained a certificate. Training is recommended for Controls Shop personnel to obtain Niagra 4 certification to enhance capabilities to manage buildings connected and controlled by UNCG's Tridium Building Automation System.

VIII. GOALS

UNC Greensboro continues to grow including increase in the campus indoor footprint. Since the baseline year, FY2003, the campus GSF has increased by 58%. However, during that same time period, UNCG has decreased its Energy Use Intensity by 24%. As of FY 2022, the University's carbon footprint has achieved a 78% reduction in water gallons/GSF surpassing the State water reduction mandate.

UNCG supports the State greenhouse gas emissions goal of a 40% reduction below 2005 levels. An official 2021 UNCG Greenhouse Gases footprint report showed 54,956 MTeCO2 which is a 25% reduction from our baseline FY09 footprint of 73,052 MTeCO2 (as far back as the inventory goes). Since 2009, the University achieved a 41% MTeCO2 reduction per 1000 gross square feet and a 29% MTeCO2 reduction per weighted campus in FY21.

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.

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 Executive Order 80 (EO80) and G.S. 143-64.12(a).

Implemented August 2022.

Energy Analyst	Director of Facilities Operations	Associate Vice Chancellor for Facilities

UNC Hospitals
Chapel Hill, NC

Strategic Energy and Water Plan

August 2022

Executive Summary

During fiscal year 2021-2022, UNC Hospitals at Chapel Hill, NC continued its commitment towards energy conservation and utility cost avoidance. This past year's primary focus was on monitoring the improvements made through American Energy Assets, LLC which was originally contracted in 2016 to review and improve the facility's utility patterns, system operations, and explore ways to reduce consumption. AEA's initial contract ended at the end of fiscal year 2019, and a maintenance-based agreement was entered into in fiscal year 2020 with AEA to prevent savings slippage. The maintenance-based agreement expired in July of 2021 and was not renewed due to budget constraints resulting from the pandemic.

UNC Hospitals continues to maintain a program of facility maintenance, improvements, and renovations that has a significant effect on controlling overall energy consumption and costs. As interior building renovations are completed, the latest energy codes are utilized to ensure that the equipment and systems being installed are compliant. In addition, Life Cycle Cost analysis and performance guidelines complying with the State Building Code, the NCAC, and the State Construction Office Construction Manual are utilized to achieve the best cost and energy performance on these projects as applicable.

The following tables summarize UNC Hospitals' performance: (1) Table 1 – Net Energy Performance, (2) Table 2 – Water/Sewer Performance, and (3) Table 3 - Energy Cost Avoidance since 2002-2003.

Table 1: Net Energy Performance (Excludes Water, Sewer, Non-potable) Fiscal Year 2002/03 to 2021/22

Fiscal Year	*Total Fiscal Year Energy Cost ($)*	*$/MMBTU*	*$/GSF*	*BTU/SQFT*	*Change in BTU/SQFT (Compared to 2002-2003)*
2002-2003	$8,089,456	$12.74	$4.18	327,754	-
2003-2004	$7,341,105	$11.75	$3.79	322,415	-2%
2004-2005	$8,247,839	$11.22	$4.26	379,383	+16%
2005-2006	$9,943,314	$14.88	$5.13	344,912	+5%
2006-2007	$10,072,484	$16.53	$5.20	314,520	-4%
2007-2008	$11,098,732	$22.16	$5.73	258,574	-21%
2008-2009	$12,369,412	$23.45	$6.39	272,312	-17%
2009-2010	$14,933,832	$24.19	$6.51	269,296	-18%
2010-2011	$15,724,242	$26.07	$6.76	259,123	-21%
2011-2012	$16,301,419	$28.44	$7.00	246,331	-25%
2012-2013	$15,580,123	$26.04	$6.69	257,094	-22%
2013-2014	$17,095,789	$27.84	$7.35	263,887	-19%
2014-2015	$16,231,427	$26.80	$6.97	260,289	-21%
2015-2016	$15,537,130	$26.68	$6.68	250,205	-24%
2016-2017	$15,342,884	$26.74	$6.59	246,508	-25%
2017-2018	$14,844,728	$28.55	$6.38	223,432	-32%
2018-2019	$14,652,897	$27.78	$6.30	226,681	-31%
2019-2020	$15,185,924	$28.45	$6.53	229,354	-30%
2020-2021	$15,102,753	$28.38	$6.49	228,647	-30%
2021-2022	$15,516,292	$29.29	$6.67	227,662	-31%

Table 2: Water/Sewer/Non-potable Consumption Performance Fiscal Year 2002/03 to 2021/22

Fiscal Year	*Total Fiscal Year Cost ($)* *[Water + Sewer + Non-potable]*	*$/1,000 Gallons*	*Gallons/SQFT*	*Gallons/SQFT % Change* *(Compared to 2002-2003)*
2002-2003	$601,556	$5.61	55.39	-
2003-2004	$758,021	$6.19	63.24	+14%
2004-2005	$814,305	$6.01	69.94	+26%
2005-2006	$912,412	$6.51	72.31	+31%
2006-2007	$947,363	$7.19	68.00	+23%
2007-2008	$939,363	$7.79	62.27	+12%
2008-2009	$1,019,309	$8.47	62.15	+12%
2009-2010	$1,244,033	$9.73	55.77	+1%
2010-2011	$1,355,235	$6.61	88.13	+59%
2011-2012	$1,389,014	$10.22	58.39	+5%
2012-2013	$1,192,381	$9.40	54.49	-2%
2013-2014	$1,438,305	$11.38	54.33	-2%
2014-2015	$1,378,546	$11.09	53.42	-4%
2015-2016	$1,347,634	$10.83	53.48	-3%
2016-2017	$1,321,025	$11.02	51.52	-7%
2017-2018	$1,437,922	$11.01	56.11	+1%
2018-2019	$1,377,440	$11.77	50.31	-9%
2019-2020	$1,304,625	$12.10	46.32	-16%
2020-2021	$1,475,234	$13.62	46.55	-16%
2021-2022	$1,535,647	$13.30	$49.61	-10%

Table 3: Energy Cost Avoidance (Excludes Water, Sewer, Non-potable), Fiscal Year 2002/03 to 2021/22

Fiscal Year	*Cost Avoidance*
2002-2003	$0 (Baseline Set)
2003-2004	$121,573
2004-2005	-$1,122,418
2005-2006	-$494,632
2006-2007	$423,842
2007-2008	$2,969,439
2008-2009	$2,518,375
2009-2010	$3,241,790
2010-2011	$4,164,737
2011-2012	$5,388,389
2012-2013	$4,282,085
2013-2014	$4,137,616
2014-2015	$4,207,090
2015-2016	$4,815,635
2016-2017	$5,056,887
2017-2018	$6,931,126
2018-2019	$6,533,517
2019-2020	$6,515,232
2020-2021	$6,546,289
2021-2022	$6,821,808

Total Energy Costs Avoided =$73,058,381

A. Accomplishments

1. The renovation of one of our chiller plants has been completed which has improved our energy consumption.
2. A fourth high-efficiency chiller has been added to this plant to complete its build-out.
3. Replacement of three cooling towers in chiller plant 2 with higher efficiency cooling towers has been completed.
4. Implementation of the use of Reuse Water has been completed.
5. Yearly tracking of energy consumption is now being performed by Plant Engineering for determining budgeting needs and for tracking usage levels overall.

6. Replaced the inefficient single pane windows located in our Bed Tower section of the Hospital.
7. Replaced exterior building seals on our APCF building to ensure that the building's exterior envelope is intact.
8. Replaced our liquid ring (water based) medical air compressors with oil-less scroll medical air compressors.
9. Replaced two MRI chillers that were at the end of their life cycle.
10. Replaced portions of the Ambulatory Patient Care Facility's North and South side roofing systems that were at the end of their life cycle.
11. Replaced one domestic water booster pump that was at the end of its life cycle.
12. Contracted with American Energy Assets, LLC in 2016 to provide energy savings through operational optimization.
13. Completed operational optimization contract with American Energy Assets, LLC at the end of fiscal year 2019.
14. Replaced the custom fluorescent tube lighting throughout the Women's & Children's Hospital with CFL and LED lighting. This project was spread across multiple years and was completed in FY2019.
15. Entered a monitoring and maintaining agreement with American Energy Assets, LLC in fiscal year 2020 to monitor optimization.
16. Completed redesign and implementation of variable flow for chillers in both chiller plants to optimize chiller loading and minimize chilled water flow thus increasing actual chilled water delta loading and off peak loads in FY2020.
17. In FY2022, implemented a renewable annual maintenance agreement with Optimum Energy LLC for diagnostic and analytic services and energy management services for maximizing central chilled water system energy efficiency under the CPO-30 control platform.
18. In FY2022, implemented a renewable annual maintenance agreement with Siemens Controls for trend based data analytics and energy management services for HVAC systems under the Siemens Desigo platform.
19. In FY2022, implemented ongoing semi-annual factory calibration program of master outdoor air temperature/humidity sensor used by all air-handler controllers for outdoor air economizer controls.
20. Began project in FY2022 to replace liquid ring vacuum pumps with electro-mechanical vacuum pumps requiring no water.

B. Energy Supply Management

1. The University of North Carolina at Chapel Hill's Energy Services Group is the provider of electrical, steam, and some chilled water services to the Hospital.
2. Orange Water and Sewer Authority is the provider of water and sewer service to the Hospital.
3. Dominion Energy is the provider of natural gas service to the Hospital.

C. Energy Use in Facilities

The hospital utilizes a state of the art Building Automation System for monitoring, tuning, and calibrating the Hospital's mechanical systems to maintain optimum control and energy efficiency.

D. Equipment Efficiency

Major new equipment purchases are based on Life Cycle Cost Analysis and replacement equipment is selected based on current efficiency guidelines.

E. Goals

1. Design and construct a new Surgical Pavilion. This project is spread across multiple years. Construction is underway. A revised plan of completion is 1st quarter of 2024.
2. Continued fine tuning of the chiller plant variable flow logic to maximize load profiles and improve energy savings.

Date of Report: *August 22, 2022*

I have read the Strategic Energy & Water plan for my Organization. The plan aligns with the reductions set forth in Senate Bill 668.

Michael S. Elks

Michael S. Elks, Director, Plant Engineering
UNC Hospitals

Strategic Energy Plan

UNIVERSITY OF NORTH CAROLINA
SCHOOL OF THE ARTS

September 2022

1. Table of Contents

2. EXECUTIVE SUMMARY

Established by the N.C. General Assembly in 1963, the University of North Carolina School of the Arts was America's first state-supported arts school. It opened in Winston-Salem "The City of Arts and Innovation" in 1965 and became part of the University of North Carolina System when it was formed in 1972.

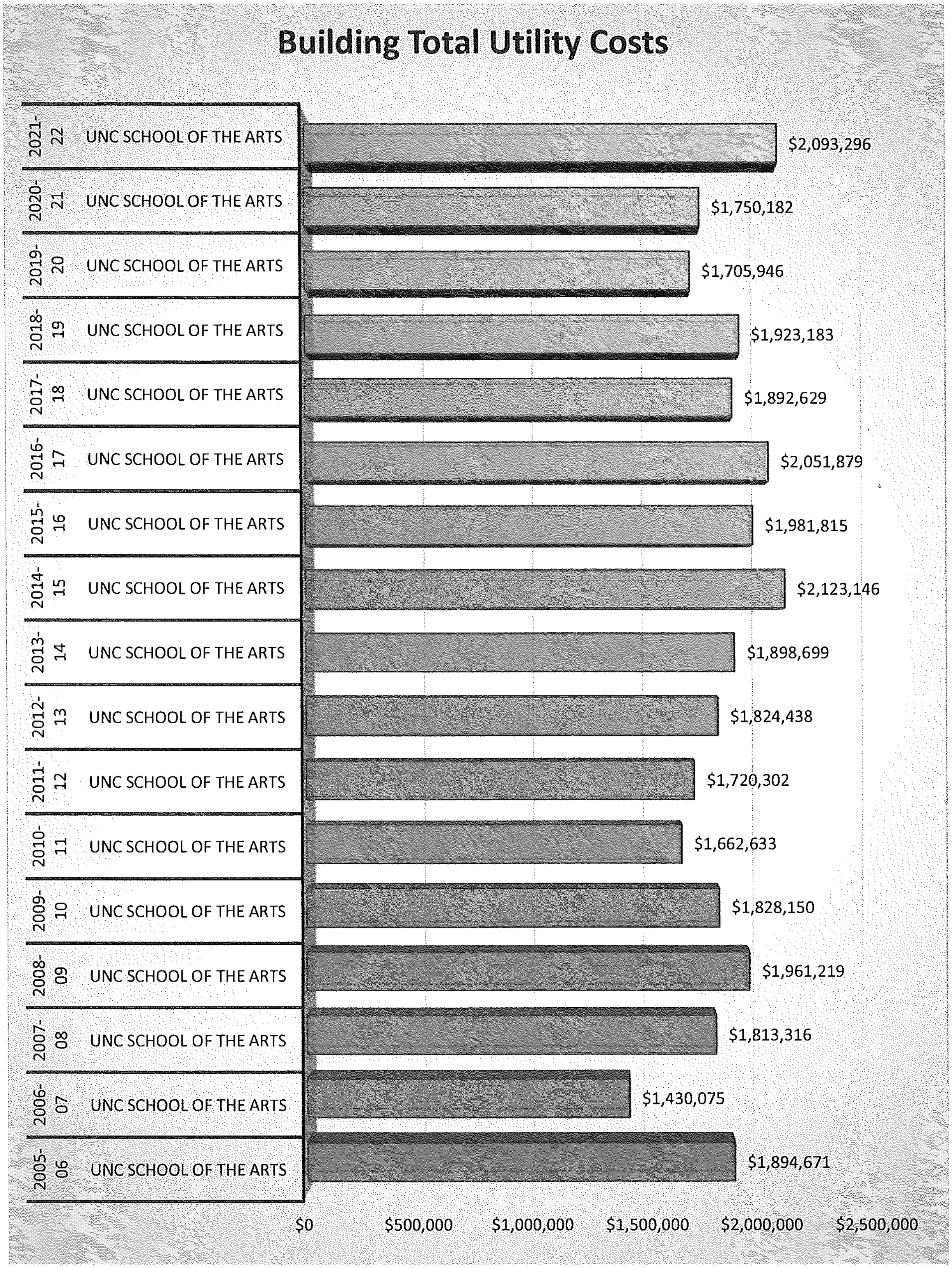
UNCSA is a unique, stand-alone public university consisting of five arts conservatories. These conservatories are: Dance, Design & Production, Drama, Filmmaking, and Music. On average more than 1,300 high school, undergraduate and graduate students are enrolled annually. The campus is south of downtown Winston-Salem and is comprised of 54 buildings with 1.25 million square feet of conditioned space, nestled on 70 acres. There are roughly 600 full-time, part-time & adjunct faculty and staff members employed at UNCSA.

UNCSA's utility mix is approximately 60% electricity, 30% natural gas and 10% water. As compared to the baseline fiscal year of 2005-06, UNCSA was able to produce a cost avoidance of $661,415.00 in the 2021-22 fiscal year. This was due to UNCSA's approach and commitment to energy conservation methods to better manage energy usage, purchase higher efficiency HVAC equipment, efforts to reduce water consumption by using low use water fixtures and continue to replace any incandescent bulbs on our campus with LED's. The University strives to replace aging and energy inefficient equipment, with higher efficiency equipment in order to meet our goals and be more sustainable when our operational and capital budgets allow. The Facilities Management technicians work in conjunction with contractors to progressively look for opportunities to conserve energy and be better stewards of our resources.

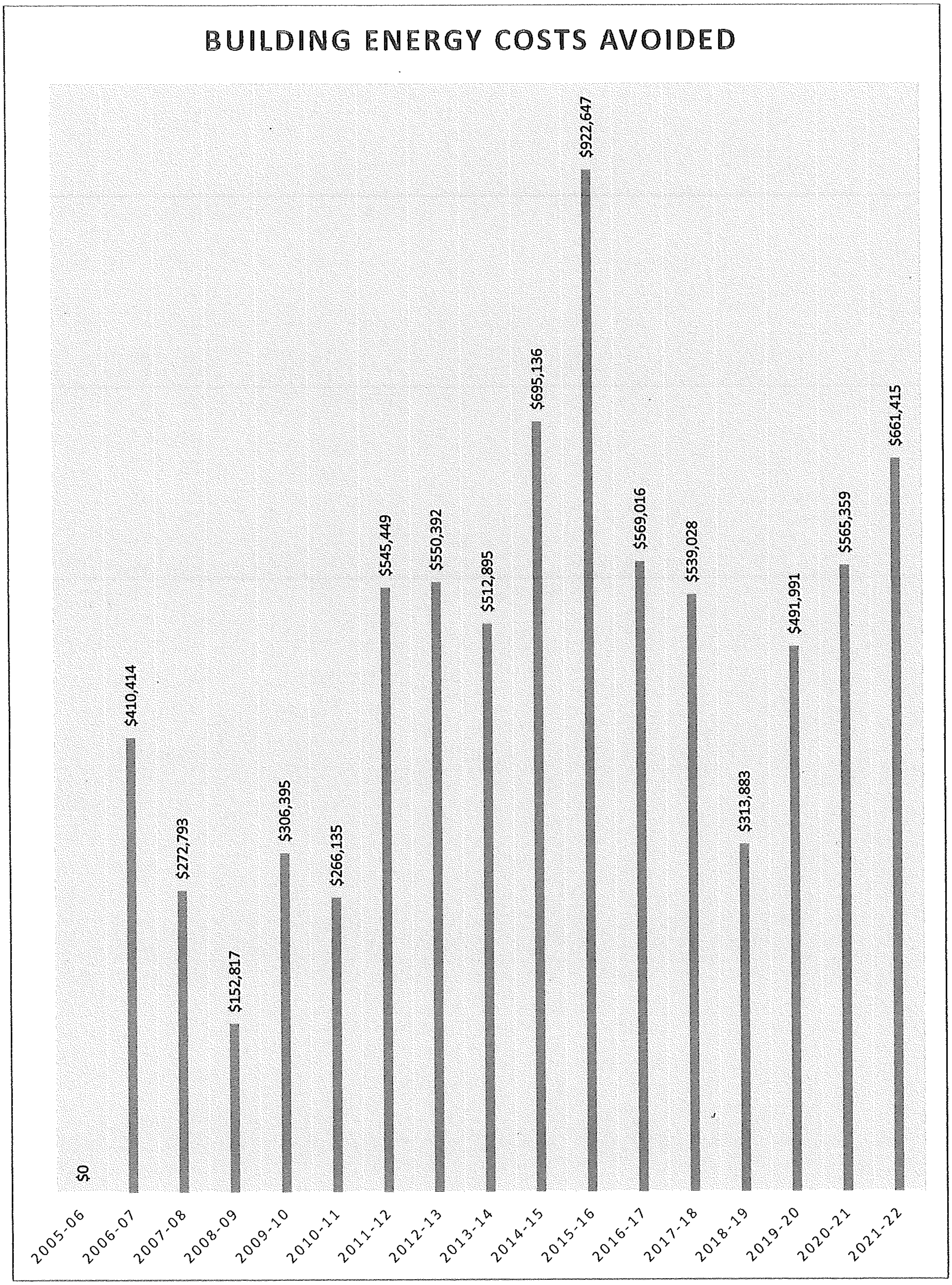
The combined energy dollar amounts per square foot is $1.50 this fiscal year, this is an increase of $0.14 as compared to the previous fiscal year. The increase is due to rate increases from our utility providers during the FY 2021-22. The energy BTU's used per square foot for FY 2021-22, was 95,087, which is 26% below our baseline FY of 2005-06. Water and sewer usage, per building square foot, increased this year 20% compared to our baseline year. This is attributed to our new residence hall coming online this year as well as returning occupancies after COVID-19 and increased hand washing efforts to avoid spreading the disease.

UNCSA is well positioned to continue to drive down our energy consumption per square foot, as so mandated by Executive Order No. 80. This Governor mandated Executive Order calls on all state-owned buildings to collectively reduce our energy consumption per square foot by 40% or more, by the year 2025. While UNCSA is one of the smaller universities in the UNC System, we are on par with other smaller universities in the system reducing our consumption per square foot and will continue to make that a priority in Facilities Management.

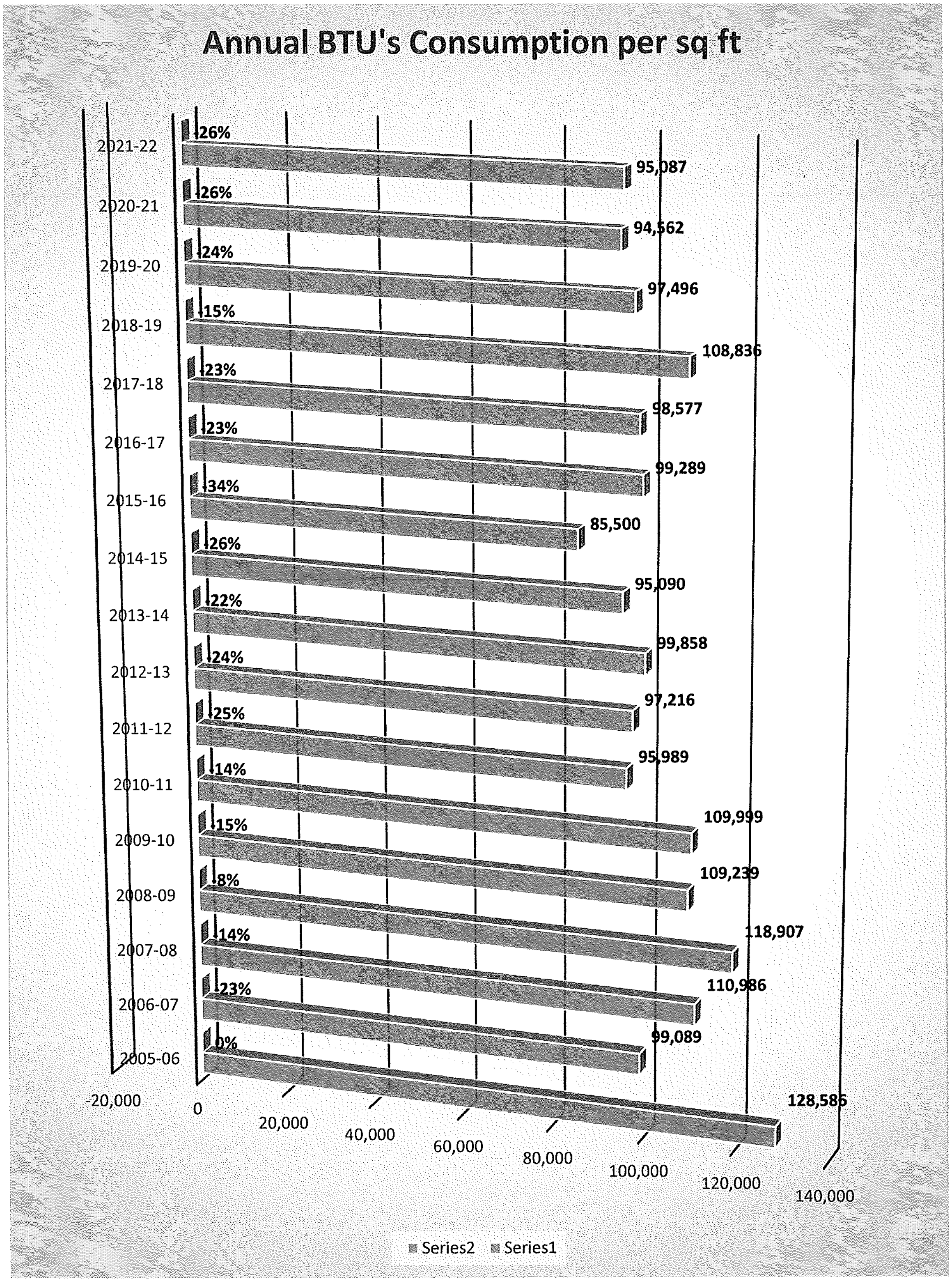
University of North Carolina School of the Arts
Strategic Energy Plan
2022-23



University of North Carolina School of the Arts
Strategic Energy Plan
2022-23



University of North Carolina School of the Arts
Strategic Energy Plan
2022-23



3. ENERGY PLAN, GOALS & STRATEGY

The Facilities Management Department strives to raise the awareness of our energy savings initiatives on our campus. We continue to educate and inform our campus community of where we are trying to move the University in respect to energy conservation. A focus has been placed on pursuing higher efficiency HVAC equipment, water heaters, low use water fixtures, lighting controls, etc. While this past fiscal years' utilities costs, as well as for the foreseeable future will continue to be impacted by the COVID-19 pandemic and how we utilize the HVAC systems in our buildings. We strive to work towards lowering our energy use; measured against the health of our students, faculty and staff learning and working in our buildings. We will no doubt continue to consume more energy due to the changes made on our HVAC equipment to lessen the potential impact of the virus and the uncertainties associated with how it spreads. The outside air dampers have been increased to bring in more air to dilute with the buildings recirculated air. For the past three fiscal years we have increased our buildings occupied schedules to ensure we have continuous air changes in all rooms. Also, we have increased all the HVAC systems air filtration systems from MERV-8 to MERV-13 that can be upgraded to that level of filtration, without causing damage or affecting the use of the system.

The FY 2021-22 saw a new residence hall, Artist Village, construction completed and it utilizes high efficiency water source heat pumps in the suites and commons areas. Also incorporated into the buildings' design was passive solar initiatives and increased wall and roof insulation that will lessen the demand for heating and cooling. We replaced several small older and less efficient HVAC systems with much higher efficient equipment in various buildings on campus. The Performance Place building's BAS was completed and now have more reliable schedules and equipment for the entire building that will no doubt reduce energy consumption. We have several other projects that are in various stages of development; HVAC system replacement at DeMille Theatre and Film Archives 1st & 2nd floor storage, cooling towers replacement at Workplace Central Plant and new LED Dimmer Theatre lighting and controls at ACE Theatre Complex. These projects are funded and hope to be completed this coming fiscal year, they will provide energy savings and energy avoidance in the future.

Additionally, Facilities Management has several projects that we are anticipating will be funded and the goal of all projects is to continue to lower the University's energy consumption, in an effort to reach a 40% reduction by 2025.

4. COMMITMENT STATEMENT

As a University we understand that energy and water consumption can and needs to be managed to our benefit. The energy and water management is a responsibility of the occupants at each facility, led and supported by Facilities Management.

The Department Heads will review progress and results semi-annually and will support staff attendance in training within energy and water management at least annually.

Strategic Energy & Water Plan Mandate – Goals

1. Reduce energy consumption by 40% per gross square foot by 2025 for all buildings, as compared to the baseline of 2005-06.
2. Require that lights be turned off in interior spaces of unoccupied buildings and upward-directed flood lighting on buildings from midnight to 6am unless required for safety, emergency, or insurance purposes.
3. Require a feasibility analysis for energy conservation measures with a specified schedule and target building sizes. The initial wave would cover buildings greater than 20,000 square feet, in operation for more than 10 years, which have not already been so evaluated within the last three years.

Strategic Energy & Water Plan Mandate – Commitment

I have read and support the Strategic Energy & Water Plan for my Organization
Implemented this 29th day of August in the year 2022.

Christopher M. Bowman	W. Stan Matt	Wendy R. Emerson
Director - Mechanical Maintenance	AVC – Facilities Management	Vice Chancellor Finance & Administration

ANNUAL REPORT
STRATEGIC ENERGY & WATER PLAN
of
UNCW

This strategic plan was developed **August 15, 2022 by**
Steve Sharpe, UNCW Energy Manager

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Executive Summary

Purpose
The purpose of this report is to summarize UNCW's utility performance (energy and water) for FY 21-22, and to list objectives and strategies for the next fiscal year. Energy usage is compared to the 2002-2003 FY as a baseline.

NC Legislative and Executive Basis for this Plan
(a.) Session Law 2007-546 / Senate Bill 668 requires that energy consumption per gross square foot be reduced 20% by 2010 and 30% by 2015 based on the 2002-2003 fiscal year as a baseline. Each State of NC institution of higher learning is to update its management plan annually and include strategies for supporting consumption reduction requirements.

(b.) Session Law 2008-203 / Senate Bill 1946 - Energy Efficiency Improvement requires an energy reduction of 30% for major construction projects and 20% for major renovation projects based on 2004 codes. Similarly, indoor potable water use for major construction or renovation projects must be 20% less, and sum of outdoor potable water use and harvested storm water use must be at least 50% less based on 2006 NC Building Code.

(c.) Executive Order No. 80 – North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy – The State of North Carolina will strive to accomplish by 2025 the reduction of energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels.

Existing Conditions
UNCW operates a total of 171 buildings, varying in age and totaling 5.1 million square feet. In addition to the buildings, we also maintain related facilities.

Key Elements and Focus Areas of the Plan
● Data collection including accurate measurement and analysis of electricity, fossil based fuels, and water usage to benchmark and to allow for regular review of costs and performance.
● Annual summary that reviews activity related to Energy Supply, Energy Demand, Communication and Training, and Water consumption.
● Identifying and implementing energy 1292 efficiency projects.
● Identifying and implementing receipt supported energy efficiency projects.

Summary of FY 21-22 Accomplishments
Energy consumption per gross square foot decreased this year. UNCW energy consumption has now been reduced by 48% compared to the FY 2002-2003 baseline, exceeding both the 30% reduction target mandated to occur by June 30, 2015 and the Governor's Executive Order of a 40% reduction by 2025. University EUI has been reduced to 84 MBTU/SF.

Significant accomplishments the past year include:
- Construction of P3 housing project with Variable Refrigerant Flow HVAC system and dedicated heat recovery / outdoor air ventilation system
- Metering Initiative
  - Upgraded Meters in Student Rec Center
  - Upgrade Sports Medicine Meters
  - Install Bear Hall Gas Meter
- Design and construction of new dining facility.
- Bear Hall Boiler Replacement
- Upgrade CHW, HHW, and DHW Systems at Sports Medicine Building
- Replace existing heat recovery in Dobo Lab with more efficient heat recovery system.
- Install Chiller Plant Optimization Software at Wag/Dobo CHW Plant.
- Expansion of Rec Center Pond Water Irrigation to School of Education Building and Cultural Arts Building
- Expansion of Front Campus Pond Water Irrigation to Alderman Hall, Hoggard Hall, and front quad area.
- Construction of Coastal Engineering Building with Variable Refrigerant Flow HVAC system and dedicated outdoor air ventilation system.

Summary of FY 22-23 plans

- Retro-Commission Various Buildings
- Minimize the use of space heaters throughout campus
- Metering Initiative
    - Continue identifying and repairing meters
    - Identify buildings deficient in metering
    - Continue tying meters into campus building management system
    - Work with billing to establish process of automating meter reading and billing.
- Building Chilled Water / Heating Hot Water circulation bridge Re-Commissioning
    - Re-Cx of building bridges as part of improving central plant efficiencies.
- Investigation of demo sized PV project and/or lease contract for larger systems
- Construction of New Student Rec Pavilion building with PV add alternate
- Construction of Randall Library Addition
- Limited Renovation of Alderman Hall and King Hall
- Expansion of Westside Chiller Plant
- Establish utility corridors to match updated campus master plan
- Upgrade Lighting CMS Ops, Oyster Hatchery, and Parking Area
- Expansion of Irrigation to front of campus, Library Commons, Kenan, DeLoach, Cultural Arts, New Housing Area, Green Track, and Soccer Area
- Investigation of UV-C Coil Cleaning and disinfection at various academic buildings.
- Investigation of bi-polar ionization at various academic buildings.
- Set up Engineering/Controls Department
- Put together long term Utilities and Infrastructure Plan for University.
- Put together long term Upgrade Plans for all campus buildings

- DECLARATION & MANDATE

Declaration

I have read the Strategic Energy & Water Plan for my organization. The plan, as presented, supports reductions required in G.S.143-64.12a.

Implemented September 2017

Commitment

- We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility, guided and supported by the Energy Manager and/or the USI (Utility Savings Initiative) liaison.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

Strategic Energy & Water Plan Mandate - Goals

(In accordance with the NC legislative and Executive basis previously described herein)
Reduce annual Total Energy Consumption by a minimum of 40% by fiscal year 2024-2025 from a baseline fiscal year of 2003.

Strategic Energy & Water Plan Mandate - Measures

Our tracking measures will be
Total Energy Use in BTU per Square Foot per Year

Strategic Energy & Water Plan Mandate - Commitment

I have read and support the Strategic Energy & Water Plan for my organization implemented August 2022.

Approval Signature(s)

(Approval is for both the Declaration and the Mandate above)

______________________________ Energy Manager

______________________________ Assoc. VC, Facilities

________________________________Vice Chancellor, Business Affairs

FOCUS A: SUPPLY SIDE

FY 21-22 Activities	Measurement		Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Check for billing errors		Monthly review		None	20 hours	Facilities	Salary
Meter verification		Quarterly		Several suspect sub-meters were identified and corrective action taken	20 hours	Facilities	Salary

Planned FY 22-23 Activities	Measurement		Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Check for billing error and meter verification	Monthly				30 hours	Energy Manager	Salary
Review continued use of marketer vs. utility for natural gas purchases	1 per year		$30,000		8 hours	Physical Plant	Salary
Conduct review of complete sub-metering system to ensure data is available remotely wherever possible, check data accuracy, etc.			Will allow accurate data collection and correct billing errors			Physical Plant	Salary budget

FOCUS B: DEMAND SIDE

FY 21-22 Activities	Measurement		Annual Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Bear Hall Boiler Replacement			$8,860		$216.526	Energy Manager	R&R / 1292
Upgrade CHW, HHW, and DHW Systems at Sports Medicine Building			$20,000		$152,721	Energy Manager	R&R / 1292
Replace existing heat recovery in Dobo Lab with more efficient heat recovery system.				$14,582	$100,000	Energy Manager	Capital
Install Chiller Plant Optimization Software at Wag/Dobo CHW Plant.				$41,359	$120,000	Energy Manager	Capital

Planned FY 22-23 Activities	Measurement		Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Replace several inaccurate sub-meters used for billing to internal campus customers	Monthly		??		$10,000	Facilities	TBD
Minimize the use of space heaters throughout campus	Monthly inspection		$5000		50 hours	Business Affairs	Salary budget
Investigate feasibility of implementing demand control	Monthly review		$25,000		$25,000	Facilities	TBD
Installation of Demonstration solar PV	Monthly		$2,500		50000	Energy Manager	Student Green Funding
Investigation of Renewable Energy Opportunities.			???		???	Energy Manager	???
Investigation control improvements for regional energy plants	Monthly		$30,000		$200,000	Energy Manager	Capital / R&R / 1292
Retro-commission Various Buildings			$70,000		$350,000	Energy Manager	Capital / R&R / 1292
Upgrade Lighting CMS Ops, Oyster Hatchery, Parking			$6,481		$116,445	Energy Manager	Capital / R&R / 1292

FOCUS C: COMMUNICATION & TRAINING

FY 21-22 Activities	Measurement Expected	Actual	Savings Expected	Actual	Cost	Assigned to	Funding Source
Communicate expected results of Performance Contract projects with building occupants	Many contacts	Ongoing	??	TBD	20 hours	Facilities	Salary budget
Met with Housing staff on several occasions to identify projects to reduce monthly energy costs	Monthly	Monthly	??	Capital project being generated for 3 Dorms and CHW/HHW Plant	10 hours	Facilities	Salary budget

Planned FY 22-23 Activities	Measurement Expected	Actual	Savings Expected	Actual	Cost	Assigned to	Funding Source
Provide information to new employees about campus energy costs	12 times		Increased awareness		4 hours	Facilities	Salary budget
Continue to tell customers of campus space temperature standards.	On-going		Increased awareness		6 hours	Facilities	Salary budget
Continue meetings with Housing staff to discuss energy consumption data	Monthly		Make decisions for future projects	TBD	10 hours	Facilities	Salary budget
Publicize successful energy projects through various methods (on campus, local media, etc)			Increased awareness	Increased awareness	10 hours	Facilities	Salary budget

Focus D: Water

FY 21-22 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Accountability	Funding Source
Expand Pond Water System to School of Education and Cultural Arts Building	Monthly	Monthly	$15,945		$10,000	Landscaping	R&R
Expand Pond Irrigation to Alderman Hall, Hoggard Hall, and front quad area	Monthly	Monthly	$47,196		$20,000	Landscaping	R&R

Planned 22-23 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Expand Pond Irrigation System to Library Commons, Kenan, and DeLoach	Monthly	Monthly	$10,000		$15,000	Landscaping	R&R
Expand Pond Irrigation System to Housing Area	Monthly	Monthly	$30,000		$100,000	Landscaping	R&R
Wagoner Central Energy Plant to Village Parking Lot SS	Monthly	Monthly	100,000		100,000	Landscaping	R&R
Green Track Tie In (Track, Softball, Soccer Entrance &Field	Monthly	Monthly	30,000		6,000	Landscaping	R&R

year	name	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $	2oil gals	2oil $	propane gals	propane $	kgal water	water sewer $	gsf	construction gsf	renovated A/C gsf
2002-03	UNC Wilmington	$4,594,973	$4,183,096	312,009,125,764	54,777,997	$3,171,476	1,251,066	$1,011,620	0	$0	0	$0	111,049	$411,877	1,937,834	0	0
2003-04	UNC Wilmington	$5,024,377	$4,578,423	315,878,095,362	56,644,518	$3,293,435	1,224,510	$1,283,104	953	$1,503	260	$381	109,431	$445,954	2,042,844	0	0
2004-05	UNC Wilmington	$5,461,252	$5,035,814	334,462,634,646	58,790,273	$3,485,560	1,335,106	$1,546,164	2,593	$4,090	0	$0	100,927	$425,438	2,194,234	0	0
2005-06	UNC Wilmington	$6,305,216	$5,819,083	356,665,765,484	62,664,798	$3,931,897	1,426,857	$1,883,943	989	$2,707	334	$536	112,160	$486,133	2,579,000	0	0
2006-07	UNC Wilmington	$6,913,056	$6,206,573	397,575,530,782	67,048,936	$4,563,704	1,687,581	$1,642,192	335	$677	0	$0	140,382	$706,483	2,935,001	0	0
2007-08	UNC Wilmington	$7,553,608	$6,771,936	404,891,148,976	72,108,933	$5,068,098	1,586,638	$1,699,330	1,382	$4,508	0	$0	154,807	$781,672	3,047,215	0	0
2008-09	UNC Wilmington	$7,228,146	$6,546,751	381,042,138,460	71,915,955	$5,320,135	1,356,649	$1,226,616	0	$0	0	$0	133,008	$681,395	3,303,907	101,458	30,081
2009-10	UNC Wilmington	$7,575,106	$6,806,789	428,199,570,679	74,226,280	$5,686,770	1,749,154	$1,119,398	0	$0	263	$621	144,721	$768,316	3,728,109	0	0
2010-11	UNC Wilmington	$7,443,987	$6,502,579	411,542,508,648	72,530,379	$5,489,054	1,639,371	$1,010,991	950	$2,534	0	$0	165,005	$941,408	3,692,732	0	0
2011-12	UNC Wilmington	$7,348,125	$6,232,953	397,115,995,226	71,737,753	$5,381,834	1,521,289	$845,874	1,571	$5,245	0	$0	168,584	$1,115,172	3,824,972	0	67,360
2012-13	UNC Wilmington	$7,292,192	$6,311,731	407,827,581,536	71,975,831	$5,403,168	1,618,566	$900,091	2,699	$8,250	165	$222	147,479	$980,461	3,977,995	0	0
2013-14	UNC Wilmington	$7,584,074	$6,674,317	406,742,227,902	75,002,326	$5,725,493	1,506,386	$944,045	1,411	$4,779	0	$0	137,257	$909,757	3,978,116	46,714	0
2014-15	UNC Wilmington	$7,560,049	$6,598,713	425,198,543,168	74,355,464	$5,802,399	1,714,977	$796,314	0	$0	0	$0	141,650	$961,336	3,986,810	0	4,454
2015-16	UNC Wilmington	$7,509,526	$6,538,267	433,180,643,980	77,369,415	$5,796,850	1,691,962	$741,416	0	$0	0	$0	135,561	$971,259	3,991,136	9,836	0
2016-17	UNC Wilmington	$7,129,932	$6,244,737	409,050,844,708	73,662,696	$5,333,883	1,574,374	$907,538	1,992	$3,316	0	$0	126,624	$885,195	4,006,035	0	0
2017-18	UNC Wilmington	$6,950,625	$6,171,611	405,140,677,980	69,838,915	$5,223,739	1,668,503	$947,872	0	$0	0	$0	106,735	$779,014	3,987,923	182,595	0
2018-19	UNC Wilmington	$7,192,789	$6,165,440	364,419,381,928	66,235,194	$5,338,311	1,384,249	$827,130	0	$0	0	$0	146,209	$1,027,349	3,960,221	362,080	110,951
2019-20	UNC Wilmington	$6,774,746	$5,895,389	365,516,219,093	64,758,299	$5,206,301	1,439,334	$679,310	4,525	$9,778	0	$0	126,084	$879,357	3,991,200	584,845	110,951
2020-21	UNC Wilmington	$7,187,625	$6,282,150	382,338,211,189	63,126,324	$5,469,147	1,662,088	$799,886	5,353	$13,117	0	$0	108,302	$905,475	4,837,267	223,092	0
2021-22	UNC Wilmington	$8,597,074	$7,477,780	428,552,533,127	76,596,317	$6,168,914	1,672,059	$1,308,867	0	$0	0	$0	133,173	$1,119,294	5,085,579	0	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
2002-03	UNC Wilmington		$2.16	$13.41		161,009			$3.71		57.31	
2003-04	UNC Wilmington	$188,985	$2.24	$14.49	8%	154,627	-4%	$31,117	$4.08	10%	53.57	-7%
2004-05	UNC Wilmington	$283,501	$2.30	$15.06	12%	152,428	-5%	$104,604	$4.22	14%	46.00	-20%
2005-06	UNC Wilmington	$955,697	$2.26	$16.32	22%	138,296	-14%	$154,437	$4.33	17%	43.49	-24%
2006-07	UNC Wilmington	$1,170,621	$2.11	$15.61	16%	135,460	-16%	$139,958	$5.03	36%	47.83	-17%
2007-08	UNC Wilmington	$1,434,005	$2.22	$16.73	25%	132,873	-17%	$100,057	$5.05	36%	50.80	-11%
2008-09	UNC Wilmington	$2,592,937	$1.98	$17.18	28%	115,331	-28%	$288,550	$5.12	38%	40.26	-30%
2009-10	UNC Wilmington	$2,735,123	$1.83	$15.90	19%	114,857	-29%	$365,897	$5.31	43%	38.82	-32%
2010-11	UNC Wilmington	$2,891,830	$1.76	$15.80	18%	111,447	-31%	$265,924	$5.71	54%	44.68	-22%
2011-12	UNC Wilmington	$3,433,240	$1.63	$15.70	17%	103,822	-36%	$334,774	$6.61	78%	44.07	-23%
2012-13	UNC Wilmington	$3,600,852	$1.59	$15.48	15%	102,521	-36%	$535,060	$6.65	79%	37.07	-35%
2013-14	UNC Wilmington	$3,835,998	$1.68	$16.41	22%	102,245	-36%	$601,250	$6.63	79%	34.50	-40%
2014-15	UNC Wilmington	$3,363,223	$1.66	$15.52	16%	106,651	-34%	$589,201	$6.79	83%	35.53	-38%
2015-16	UNC Wilmington	$3,161,043	$1.64	$15.09	13%	108,536	-33%	$667,427	$7.16	93%	33.97	-41%
2016-17	UNC Wilmington	$3,602,226	$1.56	$15.27	14%	102,109	-37%	$719,662	$6.99	88%	31.61	-45%
2017-18	UNC Wilmington	$3,609,545	$1.55	$15.23	14%	101,592	-37%	$888,937	$7.30	97%	26.76	-53%
2018-19	UNC Wilmington	$4,622,357	$1.56	$16.92	26%	92,020	-43%	$567,287	$7.03	89%	36.92	-36%
2019-20	UNC Wilmington	$4,469,389	$1.48	$16.13	20%	91,581	-43%	$715,807	$6.97	88%	31.59	-45%
2020-21	UNC Wilmington	$6,514,944	$1.30	$16.43	23%	79,040	-51%	$1,412,124	$8.36	125%	22.39	-61%
2021-22	UNC Wilmington	$6,809,836	$1.47	$17.45	30%	84,268	-48%	$1,330,153	$8.40	127%	26.19	-54%

		$/kwh	$/therm	2 oil $/gal	6 oil $/gal	propane$/gal	coal $/ton	wood $/ton	steam $/mlb	chw $/ton
2002-03	UNC Wilmington	$0.0579	$0.809	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2003-04	UNC Wilmington	$0.0581	$1.048	$1.58	$0.00	$1.47	$0.00	$0.00	$0.00	$0.00
2004-05	UNC Wilmington	$0.0593	$1.158	$1.58	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005-06	UNC Wilmington	$0.0627	$1.320	$2.74	$0.00	$1.60	$0.00	$0.00	$0.00	$0.00
2006-07	UNC Wilmington	$0.0681	$0.973	$2.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007-08	UNC Wilmington	$0.0703	$1.071	$3.26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008-09	UNC Wilmington	$0.0740	$0.904	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009-10	UNC Wilmington	$0.0766	$0.640	$0.00	$0.00	$2.36	$0.00	$0.00	$0.00	$0.00
2010-11	UNC Wilmington	$0.0757	$0.617	$2.67	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2011-12	UNC Wilmington	$0.0750	$0.556	$3.34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2012-13	UNC Wilmington	$0.0751	$0.556	$3.06	$0.00	$1.35	$0.00	$0.00	$0.00	$0.00
2013-14	UNC Wilmington	$0.0763	$0.627	$3.39	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2014-15	UNC Wilmington	$0.0780	$0.464	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2015-16	UNC Wilmington	$0.0749	$0.438	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2016-17	UNC Wilmington	$0.0724	$0.576	$1.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2017-18	UNC Wilmington	$0.0748	$0.568	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2018-19	UNC Wilmington	$0.0806	$0.598	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2019-20	UNC Wilmington	$0.0804	$0.472	$2.16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2020-21	UNC Wilmington	$0.0866	$0.481	$2.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2021-22	UNC Wilmington	$0.0805	$0.783	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

		Cost per Therm (100,000 Btu) all Energy Sources								
2002-03	UNC Wilmington	$1.70	$0.81	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2003-04	UNC Wilmington	$1.70	$1.05	$1.13	$0.00	$1.59	$0.00	$0.00	$0.00	$0.00
2004-05	UNC Wilmington	$1.74	$1.16	$1.13	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005-06	UNC Wilmington	$1.84	$1.32	$1.96	$0.00	$1.74	$0.00	$0.00	$0.00	$0.00
2006-07	UNC Wilmington	$1.99	$0.97	$1.44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007-08	UNC Wilmington	$2.06	$1.07	$2.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008-09	UNC Wilmington	$2.17	$0.90	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009-10	UNC Wilmington	$2.25	$0.64	$0.00	$0.00	$2.57	$0.00	$0.00	$0.00	$0.00
2010-11	UNC Wilmington	$2.22	$0.62	$1.91	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2011-12	UNC Wilmington	$2.20	$0.56	$2.38	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2012-13	UNC Wilmington	$2.20	$0.56	$2.18	$0.00	$1.46	$0.00	$0.00	$0.00	$0.00
2013-14	UNC Wilmington	$2.24	$0.63	$2.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2014-15	UNC Wilmington	$2.29	$0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2015-16	UNC Wilmington	$2.20	$0.44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2016-17	UNC Wilmington	$2.12	$0.58	$1.19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2017-18	UNC Wilmington	$2.19	$0.57	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2018-19	UNC Wilmington	$2.36	$0.60	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2019-20	UNC Wilmington	$2.36	$0.47	$1.54	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2020-21	UNC Wilmington	$2.54	$0.48	$1.75	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2021-22	UNC Wilmington	$2.36	$0.78	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Western Carolina University

AUGUST 1, 2022

WCU ANNUAL REPORT AND STRATEGIC ENERGY MANAGEMENT PLAN

Executive Summary

General Statute 143-64.12 requires that Western Carolina University (WCU) submit to the State Energy Office an Annual Consumption Report and an Annual Strategic Energy Plan. This report will provide an overview of the key activities within the WCU Energy Management Program. The Annual Strategic Energy Management Plan for the university highlights the achievements and efforts of the entire campus related to energy conservation.

The main campus is located in Cullowhee, North Carolina, with an additional instructional site in Asheville at Biltmore Park Towne Square. Our campus is situated on 600 acres housing almost 4 million square feet of academic, athletic, and residential living facilities with a current enrollment just under 12,000. During the fiscal year 2021-22, WCU spent $3,903,840 in utilities. This number includes electricity, natural gas, #2 oil, propane and water. Based on this year's numbers, WCU is at 83,653 BTU/sqft and 21.36 gal/sqft. All state-owned buildings use the metric of energy use intensity (EUI) and water use intensity (WUI) which allow different types of buildings to be compared by analyzing consumption per square foot. For EUI, everything that uses energy (lighting, heating, etc.) is compared to the gross square footage of campus. With campus activity returning to pre-pandemic levels and with new facilities coming online, EUI must continually be tracked. Facilities Management will continue aggressively implementing efficiency projects to minimize the impact. There are efficiency opportunities at WCU but continuing to achieve a lower EUI requires two factors: continuing to identify energy efficiency opportunities and funding for essential projects. Moving forward with energy efficiency projects in existing buildings is vital to reducing EUI. Ensuring that newly constructed and renovated campus buildings are designed and constructed with aggressive energy efficiency standards will have an even greater impact on the university's future EUI and must be prioritized.

General Statute 143-64.12 that became law in 2007 stated that all state-owned buildings achieve a 20% reduction in BTUs/sq ft by 2010 and a 30% reduction in BTUs/sqft by 2015. In October of 2018, Governor Roy Cooper issued Executive Order 80 which mandated that state-owned buildings achieve a 40% reduction in BTUs/sqft by 2025. Based on the annual BTUs/sqft of 83,653, WCU is at an all-time low of -53% from the 2002-03 baseline by statute. WCU is one of the leaders within the UNC System universities in BTU/sqft reduction. This is something that should be recognized, celebrated, and was achieved by hard work across campus.

The chart below shows the efforts across campus comparing the 2021-22 WCU averages to the UNC System Averages from 2020-21 fiscal years.

How WCU Compares to the 20-21 UNC System Averages	UNC System Averages 20-21	WCU 21-22 Averages
Cost Per Square Foot	$2.04	$0.90
BTUs/sqft reduction	-36%	-53%
Total BTU/sqft	108,174	83,653
Cost Per Million BTU	$18.82	$11.50
Annual Cost Per Student	$835.64	$328.69
Cost Per 1000 Gallons Water	$11.45	$4.35
Water Usage per Gross Sqft	18.79	21.36

As for gallons per square foot, WCU is at a 59% reduction from the same 2002-03 baseline. While this is good for WCU, the UNC System average is 18.79 gal/sqft. WCU still has some work to do on lowering this number. It should be noted that WCU has one of the lowest costs in the UNC System based on thousands of gallons at just $4.35/1000 gal. While conserving water is important, at this cost WCU continues to look first at reducing electricity and natural gas usage for the best value. WCU continues to place importance on work orders where hot water is leaking, since either electricity or natural gas is used to heat the water.

An often-overlooked metric tracked on the Annual Report is the Total Avoided Cost. This metric provides a continued look at how well an energy management program is doing. By looking at the annual costs and the annual savings in BTUs/sqft, the Total Avoided Costs are monies that WCU would have needed to pay utility bills if WCU had not had an energy management program in place. Since 2002-03, WCU has avoided over $48.5 million dollars. This year alone WCU avoided more than $5.1 million dollars. While these monies cannot be pulled out of a bucket to pay bills, it should be clear that the energy management program has continued to be highly successful.

One of the funding opportunities that WCU takes advantage of every year was created by General Statute 116-30.3B. This statute is more commonly referred to as the UNC System 1292 Carry Forward. This year, WCU requested $256,189.00 in Carry Forward funds which is WCU's largest request to date. Facilities Management and Finance working together have shown this to be a repeatable source of energy project funds. The goal of the Energy Management program is to get Carry Forward request to $500,000 per year. To date WCU has been able to Carry Forward just over $1 million dollars in the last nine years. With the savings already identified, next year's request will be close to $400,000, if not more.

While everything is moving forward, WCU must be aware of the instability currently within the cost of natural gas. You can see the pipe being run from the lower campus to the Steam Plant. The basic principle is that natural gas must have pipelines. With all the domestic and global challenges currently, the cost of natural gas has been at highs that have not been seen since Hurricane Katrina. These fluctuations have significantly increased the monthly costs to WCU, and the costs will continue to be monitored.

Conclusion:

A Strategic Energy Management Plan enables WCU to:

- **Reduce costs** – as energy costs rise.
- **Reduce carbon emissions** and the environmental damage they cause and to reduce its carbon footprint to promote a green, sustainable image.
- **Reduce risk** – the more energy WCU consumes, the greater the risk that as energy prices increase or supply shortages happen, this could affect the programs offered by the university.
- **Identify** – energy savings projects by using Life Cycle Cost Analysis (LCCA) and other methods to measure and verify potential energy savings.

As you drive around campus, you can see all the new development that is happening with the addition of 3 new residential living facilities, the completion of Apodaca/STEM, the new parking deck, and the long-awaited steam plant renovation. By this time next year, the campus will have over 3.9 million square feet of facilities. This is a total addition of over 700 thousand square feet in just a couple of years. This continued growth is good and shows a need to have energy efficiency in mind from the first design conversation until the building is operational. Energy Management must work with the occupants of that building moving forward to ensure future savings targets are achieved.

Annual Report

Chart 1 shows the costs associated with fuel sources purchased this year. The cost of electricity and natural gas make up the largest expenses with water coming in third. Electricity makes up 63% of the WCU utility spending while Natural Gas makes up 24%. WCU continues to use smaller amounts of #2 oil and propane, but this year's #2 Fuel Oil has increased as a temporary boiler has been installed as the steam plant is currently under construction. Water is just over 9% to the total utility spending. The Energy Management program will look at saving money by reducing the kilowatt hours and will save BTUs/sqft by looking at reducing natural gas and other fuels.

Chart 1

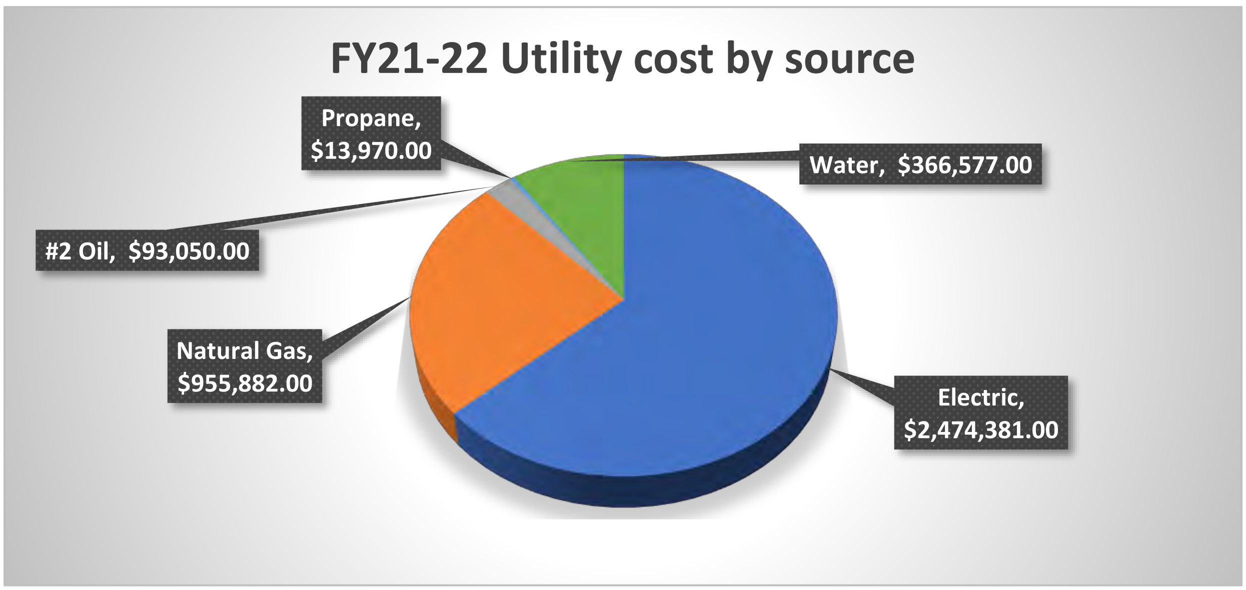
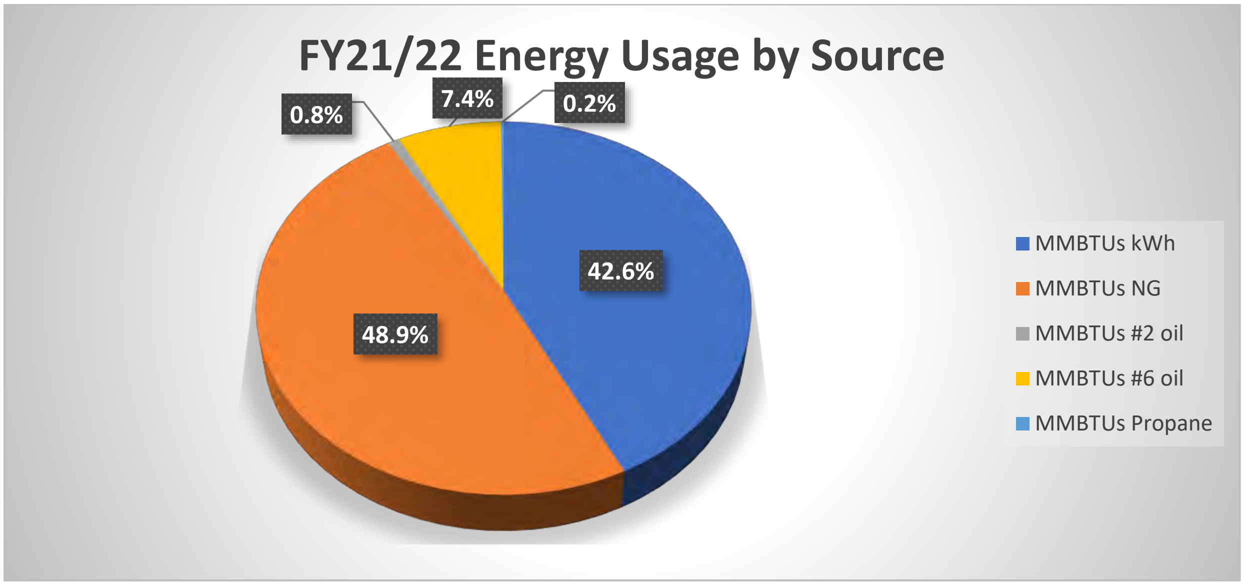


Chart 2 shows purchased fuel sources with a common denominator based on the BTUs of energy held within each source. There are significantly more BTUs in natural gas than in electricity. The Energy Management program will identify energy conservation projects that reduce Natural Gas and thus reduce WCUs BTUs/sqft annually.

Chart 2

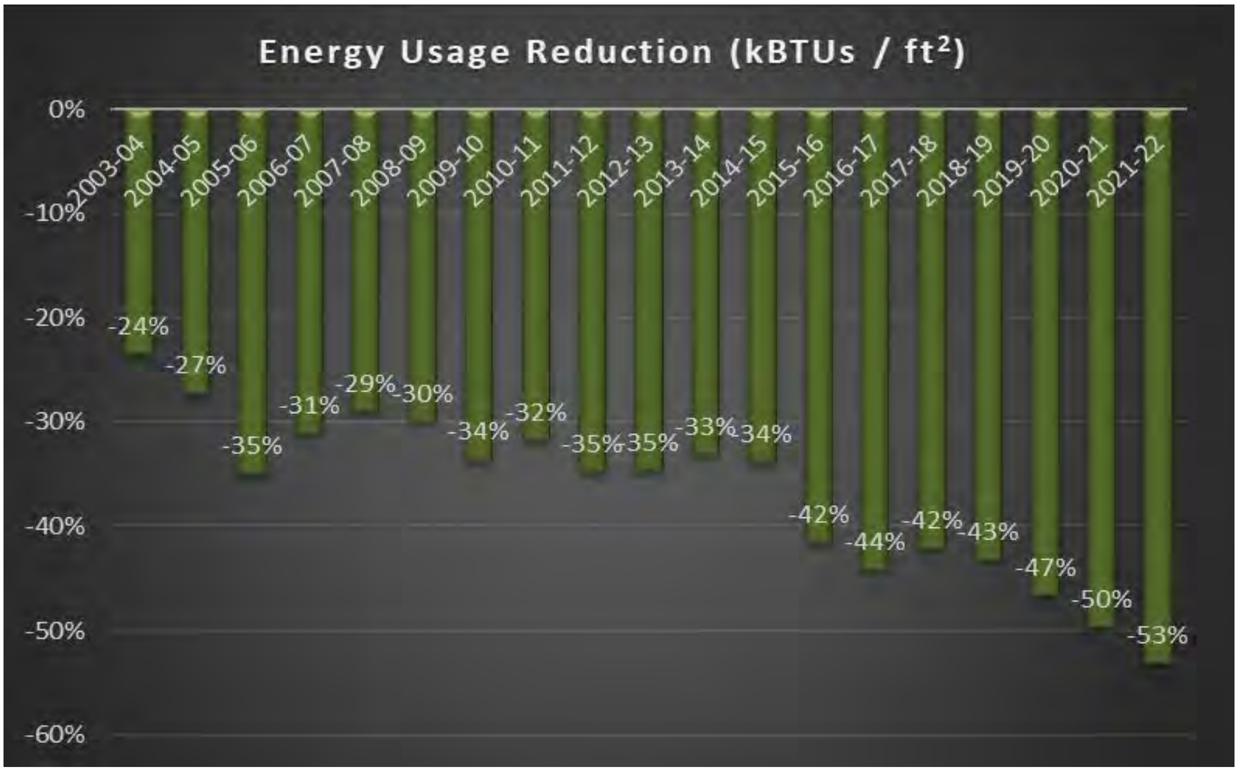


These two charts provide an explanation of the work done by the energy management program and shows the relationship between cost and BTUs. While electricity has a much higher cost, natural gas has a higher BTU count per therm. The UNC System is required to achieve a 40% reduction in BTUs/sqft by 2025 from a 2002-03 baseline as required by Governor Cooper's Executive Order 80. The goal of our energy management program is to reduce natural gas usage on campus, while at the same time maintaining comfort levels during the winter in our facilities. This is partly achieved by making sure the steam plant is operating properly with minimum steam leakage and making sure the Steam System is returning a maximum amount of condensate to the plant.

Chart 1 shows the individual fuel costs with electricity being our largest cost by far. The energy management program is keenly aware of the cost differences shown between electricity and natural gas. Another goal of the program is to try and reduce the amount annually paid for utilities. While this is a great goal, it is seldom achieved. With the continued growth on campus with both new buildings and increased students, and the ever-increasing utility rates, it is all but impossible to reduce cost. The energy management program looks at all energy conservation measures and calculates the savings in both cost and BTUs/sqft. This provides a better model for project identification. The bottom line is that if WCU wants to save BTUs/sqft then WCU must reduce natural gas usage and if WCU wants to reduce cost, WCU needs to reduce the amount of electricity used.

Based on General Statute 143-64.12 the State Agencies and the UNC System were required to achieve a 20% reduction in BTUs/sqft from a 2002-03 baseline by 2010 and a 30% reduction by 2015. Governor Cooper's Executive Order 80 added on to the statute stating that state-owned buildings are to achieve a 40% reduction by 2025. Graph 1 shows that WCU has surpassed these mandates and has achieved a record 56% reduction. WCU now leads all state-owned buildings in BTU/sqft reductions.

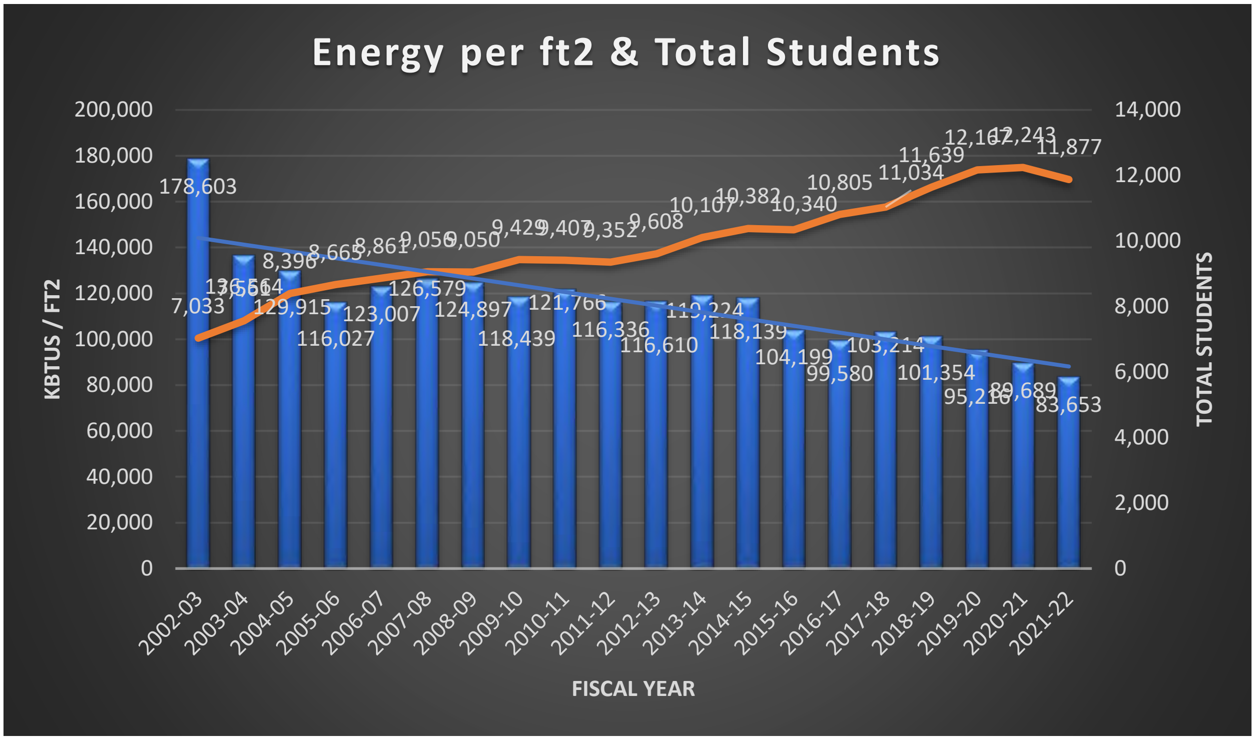
Graph 1



Graph 2 shows the correlation as it relates to the increase of the WCU student population. WCU has continued to drive down the energy usage intensity while at the same time the number of students attending WCU continues to rise. Not included in this graph is the number of additional facility and staff required to provide for both the educational programming and facility needs of the additional students.

Growth can be seen across campus the new additions this year include Apodaca and the new parking deck. We will add three new residential living facilities and an updated steam plant. All these additions make the students time here at WCU valuable and will provide lifelong memories.

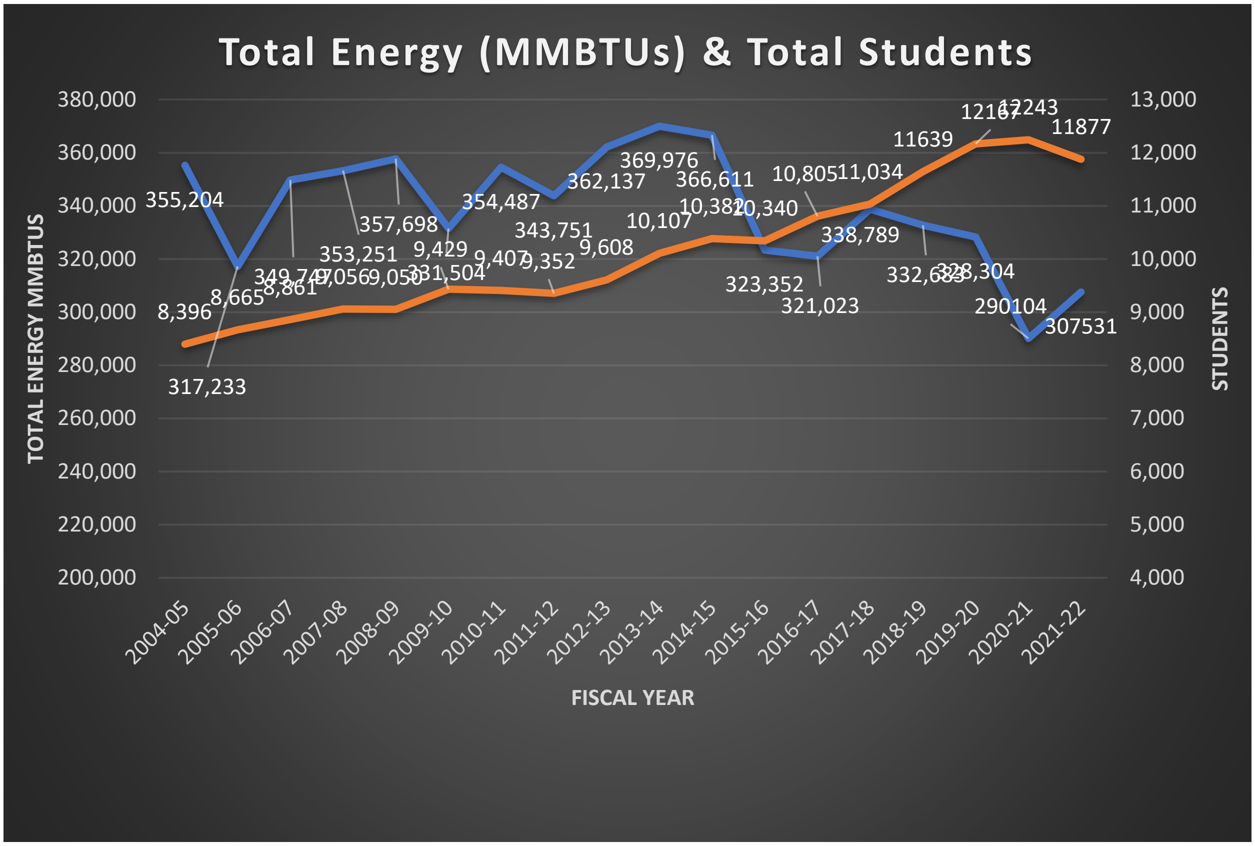
Graph 2



To look further at the relationship between the students and energy on campus the metric that was used above was BTUs/sqft. The total number of BTUs used on campus will continue to show that WCU has a successful energy management program.

Graph 3 shows the total number of students in relation to the total BTUs. The red line shows the slight reduction of students this year and the blue line shows an uptick in BTU usage. This uptick is due to the increase in #2 Oil to power the temporary boiler sitting in front of McKee. This is temporary until the steam plant is back operational in early August.

Graph 3



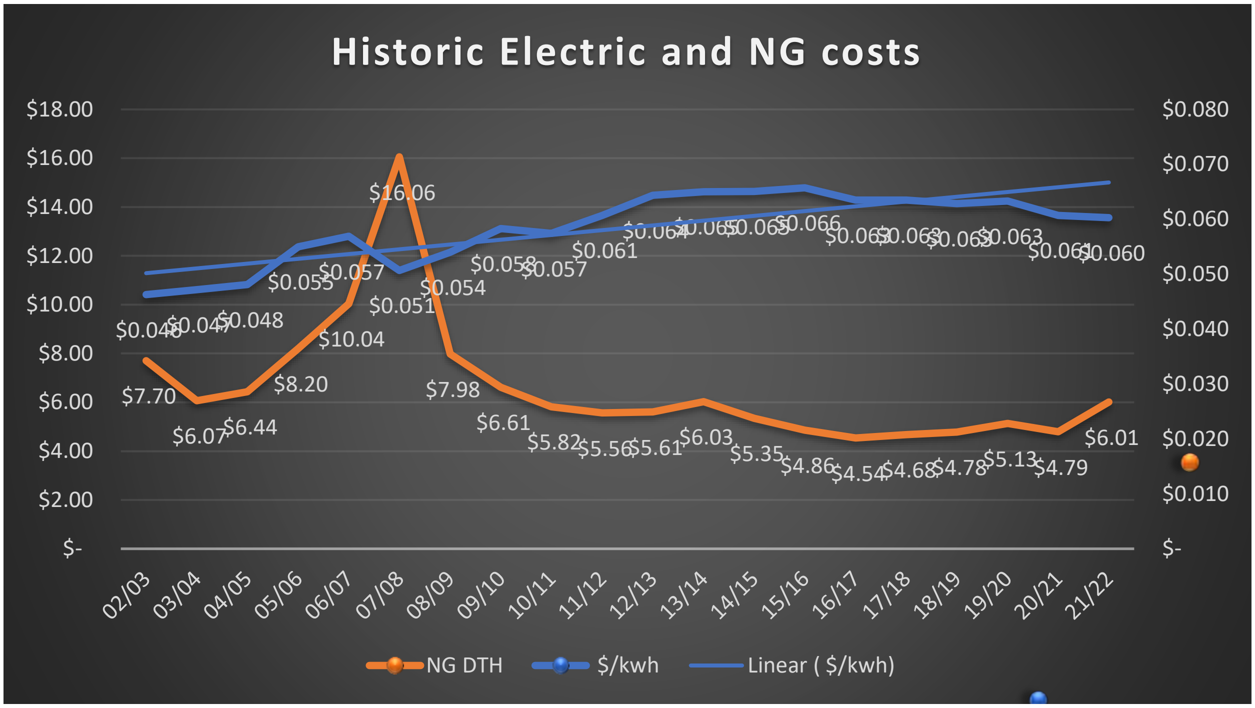
Natural Gas

There continues to be a move away from coal as the primary fuel source for power plants. As coal plants are being retired, natural gas plants are taking their place. Natural Gas is now the biggest fuel source to produce electricity in North Carolina. According to US Energy Information Administration, natural gas use for electricity generation in NC has more than quadrupled in the past decade. WCU is currently installing a natural gas line from lower campus to connect to the steam plant as it is being upgraded. Natural gas primarily moves one way, through a pipeline. Before the transition from coal, natural gas was primarily used for heating and industrial processes. Now as natural gas becomes the primary fuel source for electricity, this creates a competition for pipeline space to serve the growing need for natural gas.

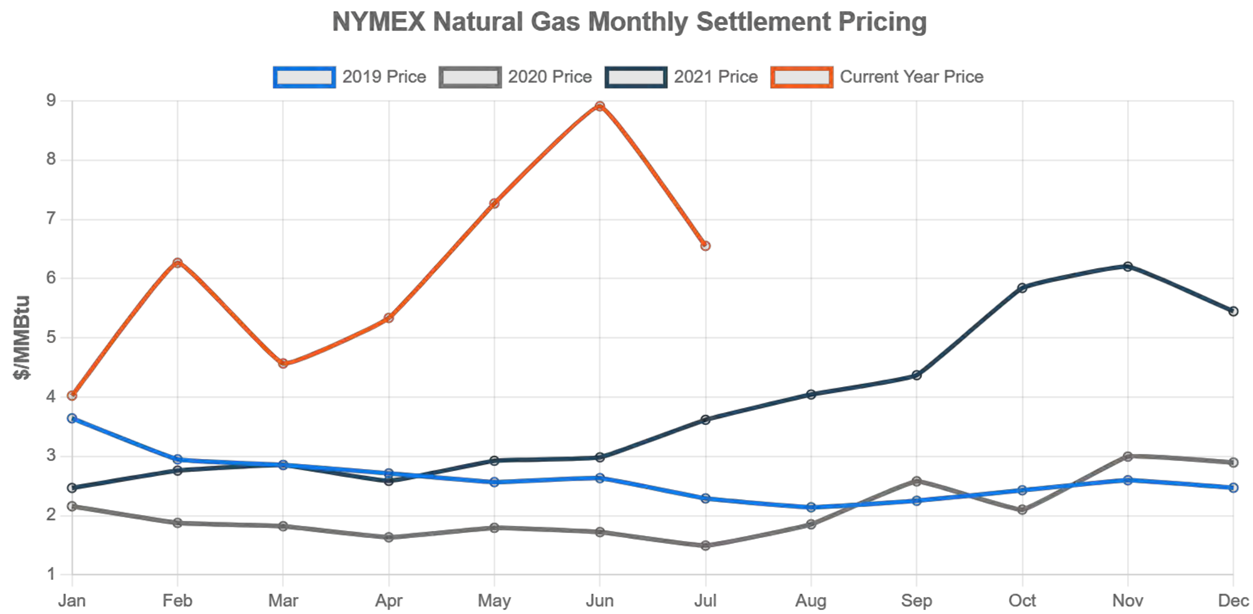
Notwithstanding arguments on both sides as to the use of fossil fuels, the problem stems from the lack of pipeline capacity and the increased need to move more natural gas. NC is beginning to have pipeline capacity issues. When pipeline capacity becomes an issue, the companies running the pipelines can charge more to the customers using the pipelines. What does this all mean to WCU? WCU has already seen an increase in cost of natural gas over the first two quarters of this year. Since last year when the cost of a Dekatherm was $4.79 the cost has risen to just over $6.01 this year. The energy management program will continue to monitor the costs as per standard practice.

Graph 3 provides a clear understanding of these metrics. While the cost of electricity has risen over the years, WCU is fortunate to see a stagnation in the cost for the past few years. This is good news for the campus and Energy Management is aware this trend cannot remain steady for much longer. Graph 4 shows the uptick in this year's cost per Dekatherm and the overall tread for natural gas since 2002-03. With everything going on in the world, natural gas costs seem to be the most impacted. Graph 5 shows the overall volatility of natural gas costs for this year as compared to the last 3 years. It is easy to realize that world events are causing issues here in Cullowhee and WCU.

Graph 4

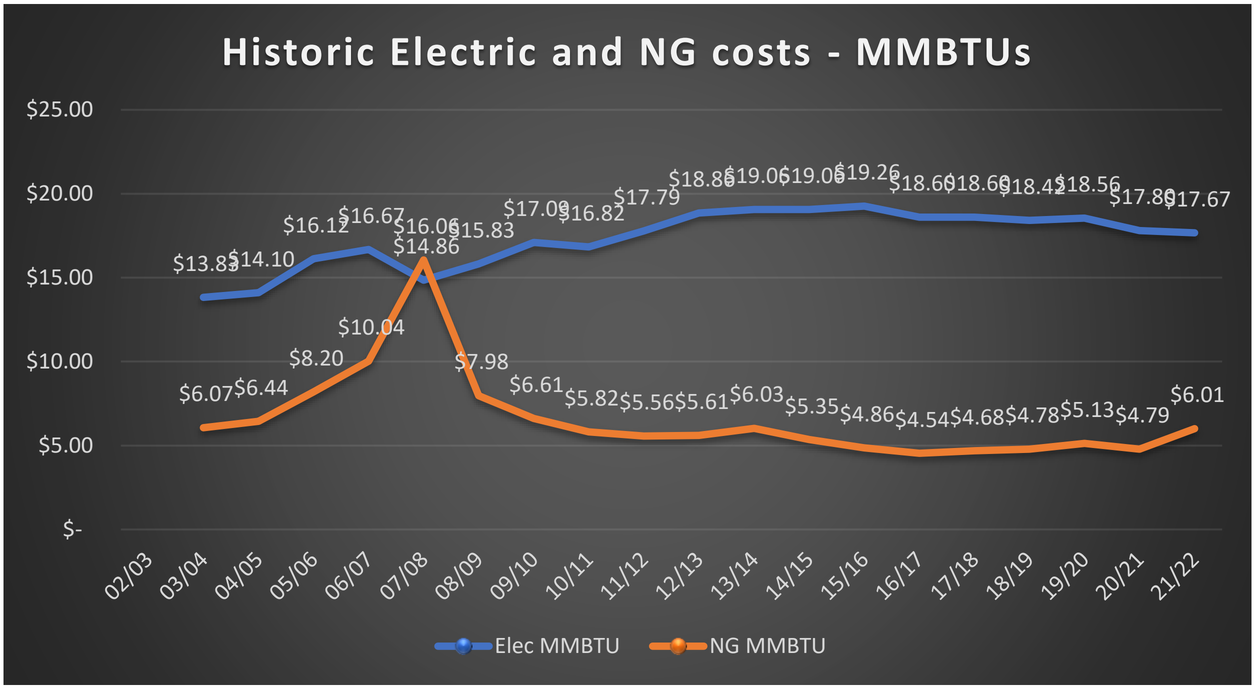


Graph 5



There continues to be a push for electrification across the nation. The Energy Management Program continues to monitor what that impact might look like here at WCU. Graph 6 shows the cost comparison for both electricity and natural gas using the same common denominator of 1,000,000 BTUs. This is commonly referred to as a Dekatherm. As the graph points out the cost per dekatherm of electricity is $17.67 and the cost per dekatherm of natural gas is $6.01. It must be noted that natural gas is not 100 percent efficient. In most cases it is at least 80% or better. This small lack of efficiency will slightly increase the cost of natural gas. If at any time there is a switch from natural gas to 100 percent electricity as the sole fuel source on campus, additional measures will need to be accommodated. Based on the information contained within this graph, WCU will need to increase the annual energy budget to ensure resources are budgeted for increased cost for electricity. Natural gas using equipment within the affected facilities will need to be replaced with equipment that only use electricity for heating. All of this can be accomplished if that is the direction WCU would like to explore.

Graph 6



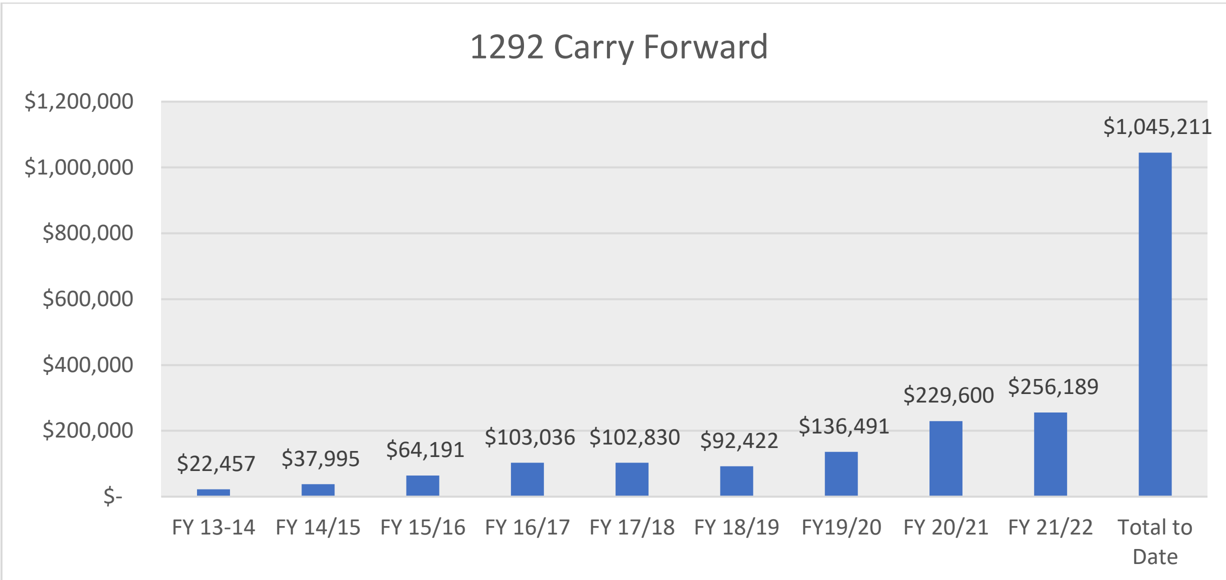
1292 Carry Forward

General Statute 116-30.3B, more commonly known as the UNC System 1292 Carry Forward, allows UNC System schools who have funds left over in the utility account at the end of the fiscal year and who have identified and measured energy savings projects through the year to carry funds forward left-over funds into the next fiscal year. These Carry Forward funds must be used for new energy efficiency projects in the next fiscal year. This year, WCU requested $256,189 in Carry Forward funds which is the largest request to date. With Facilities Management and Finance working together, this continues to be a repeatable source of funds. The goal of the Energy Management program is to get this Carry Forward request to $500,000 per year soon. To date WCU has been able to Carry Forward just over $1 million dollars in the last nine years. One of the roles of the new Senior Energy Manager is to work more closely with the departments to identify additional projects and to calculate the savings increase the 1292 Carry Forward.

Graph 7 provides an annual look at the past 1292 submissions and the total requested. Already additional ECMs have been identified for next year's 1292. These projects are for weatherstripping exterior doors, roadway lighting and several HVAC adjustments. Energy Management is working with Design and Construction to have vendors provide energy savings calculations as they submit proposals. This will help to identify the best projects and allow for increased 1292 savings moving forward. WCU is allowed to Carry

Forward savings for 12 years for all ECMs. This provides WCU a great opportunity to add projects each year that really affect the overall 1292 goals.

Graph 7



Future Facility Energy Management Projects and potential 1292 Projects

1. There are 5 buildings on campus that are on an outdated Schneider BAS system that is no longer supported. Bids are being received now from Schneider for the replacement of this system. This provides a short-term solution for about 5 years. The goal is to have these buildings converted to Automated Logic, the preferred BAS vendor on campus. In doing so, WCU has recently been informed that this could be done through a service agreement. WCU is waiting more information to make a better-informed decision. Harris has provided a potential option for a service contract which would allow the retrofit to Automated Logic and pay for it over time. This option has only just been offered and is being negotiated.
2. The Stillwell Science Lab is going through a renovation to replace some fume hoods. This project is currently being engineered by McKim and Creed. That work will begin late July and will continue through September. There is about $1 M set aside for this work. McKim and Creed will provide energy savings calculations as part of the requirements.
3. In the Killian building, WCU is doing a complete replacement of the HVAC system and duct work. This is currently being engineered by RMF at a cost of $285,000. The total project cost is approximately $3,570,000. As part of this project, it will be

important to upgrade the BAS in the Killian Annex as the Annex BAS is powered by the BAS in Killian. So, care must be taken with this project. The buildings will be operational and occupied as much as possible while construction is being completed.

4. With WCU Power providing service to part of campus, there is an opportunity for installing demand response. Energy Management will need to work with Harris to see if a data point could be established to monitor the demand from the meter. If possible, this would allow all the campus to shed load at high usage times and could potentially reduce the amount of electricity used on campus.
5. WCU has a new steam plant under construction. This 23,000 sqft addition will replace boilers that have been running campus since the 70's. This project is also updating the condense returns to the plant. Part of the efficiency of any steam plant is the amount of condense returned. This saves the cost of makeup water and energy needed to convert that water to steam.
6. WCU is currently building 3 new residential living facilities totaling more than 230,000 square feet. The facilities are replacing Walker and Scott that were torn down. These state-of-the-art facilities will be operational in late August.
7. Egress and Exit Lighting Replacement to LED – Campus wide has been identified as a quick energy payback project.
8. The Energy Management staff have identified additional 1292 projects to include weather stripping of over 200 doors on 11 buildings.
9. There are several cooling towers and chillers that need to be replaced on campus to include Hunter Cooling Tower Replacement, HFR Chiller Replacement and CAT Building Chiller Replacement.
10. There are several roof replacements that include Bird Roofing Replacement, Facilities Roof Replacement, Reid Gym Roof Replacement and HFR Roof Replacement.

WCU Annual Strategic Plan

Based on the WCU Campus Master Plan, the WCU Strategic Energy Plan must support and collaborate with the goals and objectives of the Campus Master Plan. Many of the Strategic Directives to include Academic Excellence, Student Experience, Employee Excellence and Responsible Stewardship cannot be fully achieved without the work of the Energy Management Program. The Energy Management Program must provide an optimal learning environment for the students, a healthy living and workplace by providing enhanced indoor air quality and being good stewards of the taxpayer resources used to pay utility bills, update facilities and equipment. These plans must work together to be successful.

The Strategic Plan must address the requirements mandated to WCU found within General Statutes 143-64.12, 116-30.3B and Executive Order 80. The plan must address requirements from the UNC Board of Governors Sustainability Policy. The Strategic Plan will identify daily, weekly, monthly, and yearly activities to be performed by the Energy Management Team. Many of these tasks will move around based on the urgency within a project, equipment failure or time constraints. Currently the Energy Management Team consists of a Senior Energy Manager, the Campus Energy/BAS Manager, and a BAS Controls Technician.

Yearly Tasks

1. Annual Consumption Report Due **August 15th**
   This involves the collection of all utility data to include electricity (Duke and WCU Power), natural gas (PSNC and Texican), #2 Oil, propane and water (WCU Water and TWSA).
2. Annual Program Update Due **August 15th**
   This report provides an annual look at how WCU is doing to meet the requirements found within the statutes and policies.
3. Annual Strategic Energy Plan Due **August 15th**
   This report provides the annual direction and activities of the energy management program and team.
4. Annual 1292 Report **Due May 15th**
   This report provides WCU the ability to potentially carry forward identified energy savings from one fiscal year’s budget into the next.
5. Attending the State Energy Conference (**April 25-26, 2023**)
   This provides a networking and learning opportunity for staff
6. Attend Appalachian Energy Summit Mid-Year (**Jan or Feb 2023**)
7. Attend Appalachian Energy Summit Annual Meeting (**July 2023**)
8. Identify training opportunities for staff to increase overall and specific knowledge directly related to WCU mission.
9. Manage the WCU utility budget and utility spending.

10. Provide leadership across WCU as it relates to energy issues.

Monthly Tasks

1. Oversee the reading of all electric, gas and water meters on campus.
   This is completed by the electrical and plumbing shop.
2. Compile the data into a monthly report.
   This information is compiled by the energy manager. Once approved, it is sent out and used to charge residential living and others on campus for utilities used.
3. Insert this data into spreadsheets and data base.
   Information is manually entered into the proper locations for annual tracking.
4. Analyze and investigate any anomalies.
   During the monthly data entry any readings that are out of range will be investigated and tracked down.
5. Report any meters that are not functioning for repair.
   Work orders will be filled out and submitted for repair.
6. Walk a selected number of facilities across campus to identify potential energy savings opportunities and projects.
   These will be Level 1 energy assessments to identify savings opportunities. Work orders will be created on identified issues.
7. Talk to Electrical Shop Supervisor and HVAC/Plumbing Shop Supervisor to identify potential 1292 report projects.
   If projects are identified, energy management will calculate savings and fill out 1292 paperwork and store in proper folder.
8. Energy/BAS manager and BAS Tech will monitor alarms on the BAS system.
   The goal is to have only the most important alarms that are being monitored. Minimizing unnecessary alarms that are of limited value.
9. BAS Tech will run a locked value report.
   This allows energy management to see equipment that is in hand and running without the control of the BAS.
10. Monthly communication with Design and Construction to help manage projects across campus.
11. Energy Management will work with Design and Construction to ensure energy management is included in all energy related projects across campus.
12. Senior Energy Manager and Energy/BAS Manager will provide specific energy management training for internal growth and knowledge.
13. Senior Energy Manager will work with Chief Sustainability Officer to identify ways to collaborate and provide education to faculty, staff, and students.

Weekly/Daily Tasks

1. Tuesday morning team meeting with energy management staff.
2. Attend other meetings as they are required.
3. Provide oversight of contractors on site as it relates to BAS improvements. Guiding contractors through buildings, unlocking doors, or other duties as needed to ensure job is completed.
4. Assist contractors as needed with controls upgrades/testing and balancing.
5. Aid end users with operation and scheduling of Buildings as necessary.
6. Attend weekly commissioning meeting as required for all HVAC projects on campus.
7. Assist with commissioning of new buildings and re-tuning/calibrating older buildings. Replace/repair/calibrate controls systems as needed.
8. Energy Management will communicate weekly with design and construction to continue to identify energy saving within projects.
9. Review and comment on all construction related documents in a timely fashion.
10. Continue to be a resource/facilitator for HVAC shop and HVAC technician as needed for repair and replacement of BAS and HVAC parts and equipment.
11. Daily monitoring of the BAS to identify issues and submit work orders for repairs.
12. Provide additional data to vendors as required in a timely fashion.
13. Identify energy savings opportunities through the BAS system. Once identified, Senior Energy Manager will calculate potential savings.
14. Senior Energy Manager will meet weekly with the Chief Sustainability Officer to coordinate and communicate projects that Energy Management is currently working on.

WCU Energy Management Program

To address the requirements of General Statute 143-64.12 the State Agencies and the UNC System were required to achieve a 20% reduction in BTUs/sqft from a 2002-03 baseline by 2010 and a 30% reduction by 2015. Governor Cooper's Executive Order 80 added on to the statute stating that state-owned buildings are to achieve a 40% reduction by 2025. WCU has developed this Energy Management Program to effectively manage the ongoing use of electricity, natural gas and other fuel as well as water. As the campus continues to grow in square footage, staff, faculty and students it is even more important to manage utility spending. This allows WCU to remain good stewards of all the resources that are awarded to us. When it comes to saving energy, the goal of the Energy Management Program is simple. WCU must constantly monitor, control, and conserve energy in all buildings and across campuses. Typically, this involves the following steps:

1. Metering energy consumption and collecting the data.
2. Finding opportunities to save energy and estimating how much energy each opportunity could save. By analyzing our meter data, WCU can find and quantify routine energy waste and investigate the energy savings that could be made by replacing equipment (e.g., lighting) or other building upgrades.
3. Taking action to target the opportunities to save energy (i.e., tackling the routine waste and replacing or upgrading the inefficient equipment). Typically, you'd start with the best opportunities first.
4. Tracking your progress by analyzing your meter data to see how well your energy-saving efforts have worked.

(And then back to step 2, and the cycle continues...)

It is critical that Energy Management continue to focus on the 5 areas below. By focusing on these areas, WCU can maintain the great work that has been accomplished to this point.

Energy Data Management – WCU has a program for collecting and analyzing monthly utility billing information using spreadsheets. This data is compared year to year and month to month to assess fluctuations and abnormalities that may occur. The problem is that by the time the data is reviewed it is 30 days old. While this has worked well for years, WCU needs the ability to see energy usage data today and not the end of the month. The goal is to move the progress to more real time data. This would allow WCU to see changes immediately as they take place allowing actions to be taken when problems are occurring in real time.

Energy Supply Management – WCU is proactive in selection of electrical rates and cost-effective fuel rates for all campus buildings. Energy supply management must also demonstrate choices that achieve the campus and UNC System goals to be carbon neutral by 2050, the state goal of 40% reduction in greenhouse gas emissions by 2025. Facilities Management thoroughly reviews utility invoices for deviations indicating billing errors. Work is being done to incorporate a demand-side management program that aims to lower electricity demand at peak times to help save WCU money. The goal of this plan would create a program that would reduce demand charges in real time. By being able to measure demand, WCU could set a limit on the actual demand being used at any time. If tied to the building automation system would allow for additional energy savings and a reduction in the overall electricity bought by WCU.

Energy Use in Facilities – Building HVAC and lighting controls are updated as renovations occur or as Retro-Commissioning takes place. New buildings have state-of-the-art Building Automation System (BAS) controls. New and existing building control systems will be evaluated and adjusted for optimum energy usage. The work of both the Energy Manager and Controls technician is critical to ensure optimum operation and most of all maintain the best learning environment possible. As a new requirement of the energy management team, every building will be walked every 3 months. This provides an ideal time to identify projects, spot issues and communicate with campus staff and students. These building assessments are fundamental to controlling unnecessary plug loads while allowing us to see changes in use and occupancy more often.

Equipment Efficiency – WCU requires all equipment replacements to meet or exceed code requirements. Preventive Maintenance (PM) has been moved primarily to second shift and is key to our energy efficiency program. PM has a major impact on any energy management program. It is no different here at WCU. By performing PM, WCU can keep energy using equipment running in the most efficient way. Energy Management will continue to help specify energy consuming equipment and will continue to identify and evaluate cost-effective modifications or replacements. All equipment shall be selected by Life Cycle Cost Analysis as required by statute. While funding for replacement and equipment upgrades can have their challenges, WCU will continue to take advantage of the UNC System 1292 Carry Forward funds. Larger and more capital intense equipment and projects will be identified and are normally funded through R&R capital projects.

Organization Integration & Awareness Training – The Senior Energy Manager will continue to work closely with the University Sustainability Officer for various energy conservation measures and training efforts within the appropriate University departments. The Sustainability Office priorities since 2018 are to pursue compliance with the UNC Sustainability Policy (600.6.1). Energy management is recognized in the sustainability plan under a category of “Operational Priority” with an expectation for continuous improvement for all campuses. These efforts are aimed at improving behavior and awareness in ways that contribute to the WCU continued ability to exceed the state of North Carolina mandated conservation goals. In communicating with staff, faculty, and students the goals of the Energy Management Program, WCU is hoping for continued assistance and most of all new ideas that may help the campus save energy and the environment.

Appendix 1
Executive Order 80

State of North Carolina

ROY COOPER
GOVERNOR

October 29, 2018

EXECUTIVE ORDER NO. 80

NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY

WHEREAS, North Carolina residents deserve to be better educated, healthier, and more financially secure so that they may live purposeful and abundant lives; and

WHEREAS, N.C. Const. art. XIV, ss 5 requires the conservation, protection, and preservation of state lands and waters in public trust; and

WHEREAS, North Carolina is well positioned to take advantage of its technology and research and development sectors, along with its skilled workforce, to promote clean energy technology solutions and a modernized electric grid; and

WHEREAS, public-private partnerships in North Carolina foster market innovations and develop clean energy technology solutions that grow the state's economy; and

WHEREAS, the effects of more frequent and intense hurricanes, flooding, extreme temperatures, droughts, saltwater intrusion, and beach erosion have already impacted and will continue to impact North Carolina's economy; and

WHEREAS, climate-related environmental disruptions pose significant health risks to North Carolinians, including waterborne disease outbreaks, compromised drinking water, increases in disease-spreading organisms, and exposure to air pollution, among other issues; and

WHEREAS, to maintain economic growth and development and to provide responsible environmental stewardship, we must build resilient communities and develop strategies to mitigate and prepare for climate-related impacts in North Carolina.

NOW, THEREFORE, by the authority vested in me as Governor by the Constitution and the laws of the State of North Carolina, IT IS ORDERED:

1. The State of North Carolina will support the 2015 Paris Agreement goals and honor the state's commitments to the United States Climate Alliance.

   The State of North Carolina will strive to accomplish the following by 2025:

   a. Reduce statewide greenhouse gas emissions to 40% below 2005 levels;
   b. Increase the number of registered, zero-emission vehicles ("ZEVs"; individually, "ZEV") to at least 80,000;
   c. Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels.

2. Cabinet agencies shall evaluate the impacts of climate change on their programs and operations and integrate climate change mitigation and adaptation practices into their programs and operations. Council of State members, higher education institutions, local governments, private businesses, and other North Carolina entities are encouraged to address climate change and provide input on climate change mitigation and adaptation measures developed through the implementation of this Executive Order. Consistent with applicable law, cabinet agencies shall actively support such actions.

3. The Secretary or designee of each cabinet agency and a representative from the Governor's Office shall serve on the North Carolina Climate Change Interagency Council ("Council"), which is hereby established. The Secretary of the North Carolina Department of Environmental Quality, or the Secretary's designee, shall serve as the Council Chair. The North Carolina Department of Environmental Quality shall lead the Council by providing strategic direction, scheduling and planning Council meetings, determining the prioritization of activities, facilitating stakeholder engagement, and assisting in the implementation of pathways to achieve the goals provided in Section 1 of this Executive Order.

   The duties of the Council shall include the following:

   a. Recommend new and updated goals and actions to meaningfully address climate change;
   b. Develop, implement, and evaluate programs and activities that support statewide climate mitigation and adaptation practices;
   c. Establish workgroups, as appropriate, to assist the Council in its duties;
   d. Consider stakeholder input when developing recommendations, programs, and other actions and activities;
   e. Schedule, monitor, and provide input on the preparation and development of the plans and assessments required by this Executive Order;
   f. Review and submit to the Governor the plans and assessments required by this Executive Order.

4. The North Carolina Department of Environmental Quality ("DEQ") shall develop a North Carolina Clean Energy Plan ("Clean Energy Plan") that fosters and encourages the utilization of clean energy resources, including energy efficiency, solar, wind, energy storage, and other innovative technologies in the public and private sectors, and the integration of those resources to facilitate the development of a modern and resilient electric grid. DEQ shall collaborate with businesses, industries, power providers, technology developers, North Carolina residents, local governments, and other interested stakeholders to increase the utilization of clean energy technologies, energy efficiency measures, and clean transportation solutions. DEQ shall complete the Clean Energy Plan for the Council to submit to the Governor by October I , 2019.

5. The North Carolina Department of Transportation ("DOT"), in coordination with DEQ, shall develop a North Carolina ZEV Plan ("ZEV Plan") designed to increase the number of registered ZEVs in the state to at least 80,000 by 2025. The ZEV Plan shall help establish interstate and intrastate ZEV corridors, coordinate and increase the installation of ZEV infrastructure, and incorporate, where appropriate, additional best practices for increasing ZEV adoption. DOT shall complete the ZEV Plan for the Council to submit to the Governor by October 1, 2019.

6. The North Carolina Department of Commerce ("DOC") and other cabinet agencies shall take actions supporting the expansion of clean energy businesses and service providers, clean technology investment, and companies with a commitment to procuring renewable energy. In addition, DOC shall develop clean energy and clean transportation workforce assessments for the Council to submit to the Governor by October I , 2019. These assessments shall evaluate the current and projected workforce demands in North Carolina's clean energy and clean transportation sectors, assess the skills and education required for employment in those sectors, and recommend actions to help North Carolinians develop such skills and education.

7. Cabinet agencies shall prioritize ZEVs in the purchase or lease of new vehicles and shall use ZEVs for agency business travel when feasible. When ZEV use is not feasible, cabinet agencies shall prioritize cost-effective, low-emission alternatives. To support implementation of this directive, the North Carolina Department of Administration ("DOA") shall develop a North Carolina Motor Fleet ZEV Plan ("Motor Fleet ZEV Plan") that identifies the types of trips for which a ZEV is feasible, recommends infrastructure necessary to support ZEV use, develops procurement options and strategies to increase the purchase and utilization of ZEVs, and addresses other key topics. DOA shall complete the Motor Fleet ZEV Plan and provide an accounting of each agency's ZEVs and miles driven by vehicle type for the Council to submit to the Governor by October 1, 2019, and annually thereafter.

8. Building on the energy, water, and utility use conservation measures taken pursuant to N.C. Gen. Stat. 143-64.12(a), DEQ shall update and amend, where applicable, a Comprehensive Energy, Water, and Utility Use Conservation Program ("Comprehensive Program") by February 1, 2019, and biennially beginning December I, 2019, to further reduce energy consumption per gross square foot in state buildings consistent with Section I of this Executive Order. The Comprehensive Program shall include best practices for state government building energy efficiency, training for agency staff, cost estimation methodologies, financing options, and reporting requirements for cabinet agencies. DEQ and cabinet agencies shall encourage and assist, as requested, higher education institutions, K-12 schools, and local governments in reducing energy consumption. To achieve the required energy consumption reductions:

    a. By January 1 5, 2019, each cabinet agency shall designate an Agency Energy Manager, who shall serve as the agency point of contact.

b. Each cabinet agency shall develop and submit an Agency Utility Management Plan to DEQ by March I , 2019, and biennially thereafter, and implement strategies to support the energy consumption reduction goal set forth in Section I of this Executive Order. DEQ shall assess the adequacy of these plans and their compliance with this Executive Order.
c. By September l, 2019, and annually thereafter, each cabinet agency shall submit to DEQ an Agency Utility Report detailing its utility consumption, utility costs, and progress in reducing energy consumption.
d. DEQ shall develop an annual report that describes the Comprehensive Program and summarizes each cabinet agency's utility consumption, utility costs, and achieved reductions in energy consumption. DEQ shall complete this report for publication on its website and for the Council to submit to the Governor by February 1, 2019, and annually thereafter beginning December l, 2019.

9. Cabinet agencies shall integrate climate adaptation and resiliency planning into their policies, programs, and operations (i) to support communities and sectors of the economy that are vulnerable to the effects of climate change and (ii) to enhance the agencies' ability to protect human life and health, property, natural and built infrastructure, cultural resources, and other public and private assets of value to North Carolinians.

a. DEQ, with the support of cabinet agencies and informed by stakeholder engagement, shall prepare a North Carolina Climate Risk Assessment and Resiliency Plan for the Council to submit to the Governor by March I , 2020.
b. The Council shall support communities that are interested in assessing risks and vulnerabilities to natural and built infrastructure and in developing community-level adaptation and resiliency plans.

10. DEQ shall prepare and manage a publicly accessible Web-based portal detailing the Council's actions and the steps taken to address climate-related impacts in North Carolina. Cabinet agencies shall submit data, information, and status reports as specified by the Council to be published on the portal. In addition, DEQ shall develop, publish on the portal, and periodically update an inventory of the state's greenhouse gas emissions that, among other things, tracks emissions trends statewide by sector and identifies opportunities for additional emissions reductions.

I I . By October 15, 2019, and annually thereafter, the Council shall provide to the Governor a status report on the implementation of this Executive Order.

12. This Executive Order is consistent with and does not otherwise abrogate existing state law.
13. This Order is effective October 29, 2018 and shall remain in effect until rescinded or superseded by another applicable Executive Order.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the Great Seal of the State of North Carolina at the Capitol in the City of Raleigh, this the 29th day of October, in the year of our Lord two thousand eighteen.

Roy Cooper
Governor

ATTEST:

Rodney S. Maddox
Chief Deputy Secretary of State

Appendix 2
143-64.10

Article 3B.

Conservation of Energy, Water, and Other Utilities in Government Facilities.

Part 1. Energy Policy and Life-Cycle Cost Analysis.

§ 143-64.10. Findings; policy.

(a) The General Assembly finds all of the following:

(1) That the State shall take a leadership role in aggressively undertaking the conservation of energy, water, and other utilities in North Carolina.

(2) That State facilities and facilities of State institutions of higher learning have a significant impact on the State's consumption of energy, water, and other utilities.

(3) That practices to conserve energy, water, and other utilities that are adopted for the design, construction, operation, maintenance, and renovation of these facilities and for the purchase, operation, and maintenance of equipment for these facilities will have a beneficial effect on the State's overall supply of energy, water, and other utilities.

(4) That the cost of the energy, water, and other utilities consumed by these facilities and the equipment for these facilities over the life of the facilities shall be considered, in addition to the initial cost.

(5) That the cost of energy, water, and other utilities is significant and facility designs shall take into consideration the total life-cycle cost, including the initial construction cost, and the cost, over the economic life of the facility, of the energy, water, and other utilities consumed, and of operation and maintenance of the facility as it affects the consumption of energy, water, or other utilities.

(6) That State government shall undertake a program to reduce the use of energy, water, and other utilities in State facilities and facilities of the State institutions of higher learning and equipment in those facilities in order to provide its citizens with an example of energy-use, water-use, and utility-use efficiency.

(b) It is the policy of the State of North Carolina to ensure that practices to conserve energy, water, and other utilities are employed in the design, construction, operation, maintenance, and renovation of State facilities and facilities of the State institutions of higher learning and in the purchase, operation, and maintenance of equipment for these facilities. (1975, c. 434, s. 1; 1993, c. 334, s. 2; 2001-415, s. 1; 2006-190, s. 8; 2007-546, s. 3.1(b).)

§ 143-64.11. Definitions.

For purposes of this Article:

(1) "Economic life" means the projected or anticipated useful life of a facility.

(2) "Energy-consumption analysis" means the evaluation of all energy- consuming systems, including systems that consume water or other utilities, and components of these systems by demand and type of energy or other utility use, including the internal energy load imposed on a facility by its occupants, equipment and components, and the external energy load imposed on the facility by climatic conditions.

(2a) "Energy Office" means the State Energy Office of the Department of Environmental Quality.

(2b) "Energy-consuming system" includes but is not limited to any of the following equipment or measures:

a. Equipment used to heat, cool, or ventilate the facility;
b. Equipment used to heat water in the facility;
c. Lighting systems;
d. On-site equipment used to generate electricity for the facility;
e. On-site equipment that uses the sun, wind, oil, natural gas, liquid propane gas, coal, or electricity as a power source; and

f. Energy conservation measures, as defined in G.S. 143-64.17, in the facility design and construction that decrease the energy, water, or other utility requirements of the facility.

(3) "Facility" means a building or a group of buildings served by a central distribution system for energy, water, or other utility or components of a central distribution system.
(4) "Initial cost" means the required cost necessary to construct or renovate a facility.
(5) "Life-cycle cost analysis" means an analytical technique that considers certain costs of owning, using, and operating a facility over its economic life, including but not limited to:
    a. Initial costs;
    b. System repair and replacement costs;
    c. Maintenance costs;
    d. Operating costs, including energy costs; and
    e. Salvage value.
(6) Repealed by Session Laws 1993, c. 334, s. 3, effective July 13, 1993.
(7) "State agency" means the State of North Carolina or any board, bureau, commission, department, institution, or agency of the State.
(8) "State-assisted facility" means a facility constructed or renovated in whole or in part with State funds or with funds guaranteed or insured by a State agency.
(9) "State facility" means a facility constructed or renovated, by a State agency.
(10) "State institution of higher learning" means any constituent institution of The University of North Carolina. (1975, c. 434, s. 2; 1989, c. 23, s. 1; 1993, c. 334, s. 3; 2001-415, s. 2; 2006-190, ss. 9, 10, 11; 2007-546, s. 3.1(c); 2009-446, s. 1(f); 2013-360, s. 15.22(o); 2015-241, s. 14.30(u).)

§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office a biennial written report of utility consumption and costs. Management plans submitted biennially by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.
(2) The cost of analyzing the projected energy savings.
(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.
(4) An analysis that identifies projected annual energy savings and estimated payback periods.

(a1) State agencies and State institutions of higher learning shall carry out the construction and renovation of facilities in such a manner as to further the policy set forth under this section and to ensure the use of life-cycle cost analyses and practices to conserve energy, water, and other utilities.

(b) The Department of Administration shall develop and implement policies, procedures, and standards to ensure that State purchasing practices improve efficiency regarding energy, water, and other utility use and take the cost of the product over the economic life of the product into consideration. The Department of Administration shall adopt and implement Building Energy Design Guidelines. These guidelines shall include energy-use goals and standards, economic assumptions for life-cycle cost analysis, and other criteria on building systems and technologies. The Department of Administration shall modify the design criteria for construction and renovation of facilities of State buildings and State institutions of higher learning buildings to require that a life-cycle cost analysis be conducted pursuant to G.S. 143-64.15.

(b1) The Department of Administration, as part of the Facilities Condition and Assessment Program, shall identify and recommend energy conservation maintenance and operating procedures that are designed to reduce energy consumption within the facility of a State agency or a State institution of higher learning and that require no significant expenditure of funds. Every State agency or State institution of higher learning shall implement these recommendations. Where energy management equipment is proposed for any facility of a State agency or of a State institution of higher learning, the maximum interchangeability and compatibility of equipment components shall be required. As part of the Facilities Condition and Assessment Program under this section, the Department of Administration, in consultation with the State Energy Office, shall develop an energy audit and a procedure for conducting energy audits. Every five years the Department shall conduct an energy audit for each State agency or State institution of higher learning, and the energy audits conducted shall serve as a preliminary energy survey. The State Energy Office shall be responsible for system-level detailed surveys.

(b2) The Department of Administration shall submit a report of the energy audit required by subsection (b1) of this section to the affected State agency or State institution of higher learning and to the State Energy Office. The State Energy Office shall review each audit and, in consultation with the affected State agency or State institution of higher learning, incorporate the audit findings and recommendations into the management plan required by subsection (a) of this section.

(c) through (g) Repealed by Session Laws 1993, c. 334, s. 4.

(h) When conducting a facilities condition and assessment under this section, the Department of Administration shall identify and recommend to the State Energy Office any facility of a State agency or State institution of higher learning as suitable for building commissioning to reduce energy consumption within the facility or as suitable for installing an energy savings measure pursuant to a guaranteed energy savings contract under Part 2 of this Article.

(i) Consistent with G.S. 150B-2(8a)h., the Department of Administration may adopt architectural and engineering standards to implement this section.

(j) The State Energy Office shall submit a report by December 1 of every odd-numbered year to the Joint Legislative Energy Policy Commission, the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division describing the comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning required by subsection (a) of this section. The report shall also contain the following:

(1) A comprehensive overview of how State agencies and State institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains.

(2) Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed.

(3) A summary of the State agency and State institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section.

(4) A list of the State agencies and State institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the State agencies and State institutions of higher learning that received an energy audit.

(5) Any recommendations on how management plans can be better managed and implemented. (1975, c. 434, s. 3; 1993, c. 334, s. 4; 2000-140, s. 76(f); 2001-415, s. 3; 2006-190, s. 12; 2007-546, s. 3.1(a); 2008-198, s. 11.1; 2009-446, s. 1(e); 2010-31, s. 14.3; 2010-196, s. 2; 2013-360, s. 15.22(p); 2014-120, s. 55; 2015-241, s. 14.30(u); 2017-57, s. 14.1(f).)

§ 143-64.13: Repealed by Session Laws 1993, c. 334, s. 5.

§ 143-64.14: Recodified as § 143-64.16 by Session Laws 1993, c. 334, s. 7.

§ 143-64.15. Life-cycle cost analysis.

(a) A life-cycle cost analysis shall be commenced at the schematic design phase of the construction or renovation project, shall be updated or amended as needed at the design development phase, and shall be updated or amended again as needed at the construction document phase. A life-cycle cost analysis shall include, but not be limited to, all of the following elements:

(1) The coordination, orientation, and positioning of the facility on its physical site.

(2) The amount and type of fenestration and the potential for daylighting employed in the facility.

(3) Thermal characteristics of materials and the amount of insulation incorporated into the facility design.

(4) The variable occupancy and operating conditions of the facility, including illumination levels.

(5) Architectural features that affect the consumption of energy, water, and other utilities.

(b) The life-cycle cost analysis performed for any State facility shall, in addition to the requirements set forth in subsection (a) of this section, include, but not be limited to, all of the following:

(1) An energy-consumption analysis of the facility's energy-consuming systems in accordance with the provisions of subsection (g) of this section.

(2) The initial estimated cost of each energy-consuming system being compared and evaluated.

(3) The estimated annual operating cost of all utility requirements.

(4) The estimated annual cost of maintaining each energy-consuming system.

(5) The average estimated replacement cost for each system expressed in annual terms for the economic life of the facility.

(c) Each entity shall conduct a life-cycle cost analysis pursuant to this section for the construction or the renovation of any State facility or State-assisted facility of 20,000 or more gross square feet. For the replacement of heating, ventilation, and air-conditioning equipment in any State facility or State-assisted facility of 20,000 or more gross square feet, the entity shall conduct a life-cycle cost analysis of the replacement equipment pursuant to this section when the replacement is financed under a guaranteed energy savings contract or financed using repair and renovation funds.

(d) The life-cycle cost analysis shall be certified by a registered professional engineer or bear the seal of a North Carolina registered architect, or both. The engineer or architect shall be particularly qualified by training and experience for the type of work involved, but shall not be employed directly or indirectly by a fuel provider, utility company, or group supported by fuel providers or utility funds. Plans and specifications for facilities involving public funds shall be designed in conformance with the provisions of G.S. 133-1.1.

(e) In order to protect the integrity of historic buildings, no provision of this Article shall be interpreted to require the implementation of measures to conserve energy, water, or other utility use that conflict with respect to any property eligible for, nominated to, or entered on the National Register of Historic Places, pursuant to the National Historic Preservation Act of 1966, P.L. 89-665; any historic building located within an historic district as provided in Chapters 160A or 153A of the General Statutes; any historic building listed, owned, or under the jurisdiction of an historic properties commission as provided in Chapter 160A or 153A; nor any historic property owned by the State or assisted by the State.

(f) Each State agency shall use the life-cycle cost analysis over the economic life of the facility in selecting the optimum system or combination of systems to be incorporated into the design of the facility.

(g) The energy-consumption analysis of the operation of energy-consuming systems utilities in a facility shall include, but not be limited to, all of the following:

(1) The comparison of two or more system alternatives.

(2) The simulation or engineering evaluation of each system over the entire range of operation of the facility for a year's operating period.

(3) The engineering evaluation of the consumption of energy, water, and other utilities of component equipment in each system considering the operation of such components at other than full or rated outputs. (1993, c. 334, s. 6; 2001-415, ss. 4, 5; 2006-190, s. 13; 2007-546, s. 4.1.)

§ 143-64.15A. Certification of life-cycle cost analysis.

Each State agency and each State institution of higher learning performing a life-cycle cost analysis for the purpose of constructing or renovating any facility shall, prior to selecting a design option or advertising for bids for construction, submit the life-cycle cost analysis to the Department for certification at the schematic design phase and again when it is updated or amended as needed in accordance with G.S. 143-64.15. The Department shall review the material submitted by the State agency or State institution of higher learning, reserve the right to require an agency or institution to complete additional analysis to comply with certification, perform any additional analysis, as necessary, to comply with G.S. 143-341(11), and require that all construction or renovation conducted by the State agency or State institution of higher learning comply with the certification issued by the Department. (2001-415, s. 6; 2007-546, s. 4.2.)

§ 143-64.16. Application of Part.

The provisions of this Part shall not apply to municipalities or counties, nor to any agency or department of any municipality or county; provided, however, this Part shall apply to any board of a community college. Community college is defined in G.S. 115D-2(2). (1975, c. 434, s. 5; 1989, c. 23, s. 2; 1993, c. 334, s. 7; 1993 (Reg. Sess., 1994), c. 775, s. 2.)

Appendix 3
1292 CARRY FORWARD

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2009
SESSION LAW 2010-196
HOUSE BILL 1292
H1292-v-6

AN ACT TO PROVIDE THAT ANY ENERGY SAVINGS REALIZED BY CONSTITUENT INSTITUTIONS OF THE UNIVERSITY OF NORTH CAROLINA SHALL REMAIN AVAILABLE TO THE INSTITUTION AND A PORTION OF THOSE ENERGY SAVINGS SHALL BE USED FOR OTHER ENERGY CONSERVATION MEASURES; AND TO EXPAND THE USE OF OPERATIONAL LEASES BY LOCAL BOARDS OF EDUCATION.

The General Assembly of North Carolina enacts:

SECTION 1. Article 1 of Chapter 116 of the General Statutes is amended by adding a new section to read:

"§ 116-30.3B. Energy conservation savings.

(a) In addition to the funds carried forward under G.S. 116-30.3, the General Fund current operations appropriations credit balance remaining at the end of each fiscal year for utilities of a constituent institution that is energy savings realized from implementing an energy conservation measure shall be carried forward by the institution to the next fiscal year. Sixty percent (60%) of the energy savings realized shall be utilized for energy conservation measures by that institution. The use of funds under this section shall be limited to onetime capital and operating expenditures that will not impose additional financial obligations on the State. The Director of the Budget, under the authority set forth in G.S. 143C-6-2, shall establish the General Fund current operations credit balance remaining in each budget code of each institution.

(b) The Director of the Budget shall not decrease the recommended continuation budget requirements for utilities for constituent institutions by the amount of energy savings realized from implementing energy conservation measures, including savings achieved through a guaranteed energy savings contract.

(c) Constituent institutions shall submit annual reports on the use of funds authorized pursuant to this section as required under G.S. 143-64.12.

(d) As used in this section, 'energy savings,' 'guaranteed energy savings contract,' and 'energy conservation measure' have the same meaning as in G.S. 143-64.17."

SECTION 2. G.S. 143-64.12(a) reads as rewritten:

"(a) The Department of Commerce through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan annually and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office an annual written report of utility consumption and costs. Management plans submitted annually by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.

(2) The cost of analyzing the projected energy savings.

(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.

(4) An analysis that identifies projected annual energy savings and estimated payback periods."

SECTION 3. G.S. 115C-530 reads as rewritten:

"§ 115C-530. Operational leases of school buildings and school facilities.

(a) Local boards of education may enter into operational leases of real or personal property for use as school buildings or school facilities. Operational leases for terms of less than three years shall not be subject to the approval of the board of county commissioners. Operational leases for terms of three years or longer, including periods that may be added to the original term through the exercise of options to renew or extend, are permitted if all of the following conditions are met:

(1) The budget resolution includes an appropriation authorizing the current fiscal year's portion of the obligation.

(2) An unencumbered balance remains in the appropriation sufficient to pay in the current fiscal year the sums obligated by the lease for the current fiscal year.

(3) The leases are approved by a resolution adopted by the board of county commissioners. If an operational lease is approved by the board of county commissioners, in each year the county commissioners shall appropriate sufficient funds to meet the amounts to be paid during the fiscal year under the lease.

(4) Any construction, repair, or renovation of the property is in compliance with the requirements of G.S. 115C-521(c) relating to energy guidelines.

For purposes of this section, an operational lease is defined according to generally accepted accounting principles. principles and may be for new or existing buildings.

(b) Local boards of education may enter into contracts for the repair construction, repair, or renovation of leased property if (i) the budget resolution includes an appropriation authorizing the obligation, (ii) an unencumbered balance remains in the appropriation sufficient to pay in the current fiscal year the sums obligated by the transaction for the current fiscal year, and (iii) the repair construction, repair, or renovation is in compliance with the requirements of G.S. 115C-521(c) relating to energy guidelines. Construction, repair, or renovation work undertaken or contracted by a private developer is subject to the requirements of Article 8 of Chapter 143 of the General Statutes. Contracts for new construction and renovation that are subject to the bidding requirements of G.S. 143-129(a) and which do not constitute continuing contracts for capital outlay must be approved by the board of county commissioners.

(c) Operational leases and contracts entered into under this section are subject to approval by the Local Government Commission under Article 8 of Chapter 159 of the General Statutes if they meet the standards set out in G.S. 159-148(a)(1), 159-148(a)(2), and 159-148(a)(3). For purposes of determining whether the standards set out in G.S. 159-148(a)(3) have been met, only the five hundred thousand dollar ($500,000) threshold shall apply."

SECTION 4. This act becomes effective July 1, 2010, and applies to contracts entered into on or after that date.

In the General Assembly read three times and ratified this the 9th day of July, 2010.

s/ Walter H. Dalton
President of the Senate

s/ Joe Hackney
Speaker of the House of Representatives

This bill having been presented to the Governor for signature on the 9th day of July, 2010 and the Governor having failed to approve it within the time prescribed by law, the same is hereby declared to have become a law. This 10th day of August, 2010.

Appendix 4
UNC Sustainability Policy 600.6.1

The University of North Carolina Sustainability Policy

The University of North Carolina ("The University") is committed to leading the State of North Carolina as an environmental steward that endeavors to proactively and effectively manage its impact on energy, water and other natural resources. Further, The University is obligated to ensure full compliance with all applicable local, state, and federal environmental laws and regulations. Therefore, it is the policy of The University's Board of Governors (the "Board") that The University, including General Administration, the constituent institutions, and affiliated entities, shall establish sustainable development and resource management, or "sustainability" as a core value of institutional operations, planning, capital construction, and purchasing practices.

Budgetary constraints, capital improvement and modernization requirements, and training and management needs required to facilitate the implementation of these sustainable practices are limiting factors and, as such, the University's General Administration, in collaboration with the constituent institutions and affiliated entities, shall pursue the appropriate enabling legislation and funding to implement this policy. The Board recognizes that the goals of this policy range from short-term to long-term and adds further emphasis on the importance of the aspirational nature of the highest ideals of sustainability. In addition, the Board values Return on Investment (ROI) as a factor in institutional resource planning and decision making and requires an ROI calculation for any new project.

The Board delegates authority to the President to implement the following sustainable practices to apply to each constituent institution and, when appropriate, General Administration and affiliated entities:

Systematic Integration of Sustainability Principles: Systematically incorporate sustainability throughout the institution by integrating the policy goals into the institution's processes, administration, teaching, research, and engagement. Each constituent institution and affiliated entity and General Administration shall designate an appropriate individual to serve as "Chief Sustainability Officer" to be responsible for implementation of this policy.

Master Planning: Sustainability principles related to infrastructure, natural resources, site development, and community impact shall be incorporated into comprehensive master plans.

Design and Construction: Capital project planning and construction processes shall meet statutory energy and water efficiency requirements and deliver energy, water, and materials efficient buildings and grounds that minimize the impact on and/or enhance the site and provide good indoor environmental quality for occupants.

Operations and Maintenance: The operation and maintenance of buildings and grounds shall meet or exceed statutory requirements to reduce energy and water use, provide excellent air quality and comfort, improve productivity of faculty, staff and students, and minimize materials use. Further, priority shall be given to the purchase and installation of high-efficiency equipment and facilities as part of an ongoing sustainability action plan following life cycle cost guidelines where applicable.

Climate Change Mitigation and Renewable Energy: The University shall develop a plan to become carbon neutral as soon as practicable and by 2050 at the latest, with an ultimate goal of climate neutrality.

Transportation: The University shall develop and implement a comprehensive, multimodal transportation plan designed to reduce carbon emissions and dependency on single occupant vehicles.

Recycling and Waste Management: The University shall develop policies and programs that work toward achieving zero waste and will comply with the provisions of NC General Statute 130A-309.14 regarding recycling and waste management.

Environmentally Preferable Purchasing (EPP): Any purchasing shall, to the extent practicable, improve the environmental performance of its supply chain with consideration given to toxicity, recycled content, energy and water efficiency, rapidly renewable resources, and local production and shall also improve the social performance of its supply chain with consideration given to working conditions and historically underutilized businesses.

The President shall develop and implement best practices, guidelines, and implementation plans necessary to achieve the goals of this policy to the constituent institutions and affiliated entities. This policy shall be reviewed every two (2) years by the President, and any necessary revisions and modifications shall be recommended to the Board for its consideration.

WINSTON-SALEM
STATE UNIVERSITY

Strategic Energy Plan

August 2022

EXECUTIVE SUMMARY

Existing Conditions/Background

Winston-Salem State University (WSSU) is a comprehensive, Historically Black University offering innovative undergraduate programs and exceptional graduate programs grounded in the tradition of liberal education. Since its founding in 1892, WSSU has grown from a one-room frame structure to more than forty-five buildings located on a picturesque 117-acre campus in the heart of Winston-Salem NC. Currently university buildings comprise approximately 2,000,000 gross square feet (GSF).
With a student-to-faculty ratio of 14:1 and a student body of more than 5,100, the university offers thirty-four baccalaureate degrees, seven master's degree programs, two professional doctorate programs and six certificate programs.

Control of utility costs and usage are one of the Goals of the WSSU Campus Strategic Plan. Stewardship of university resources and awareness of our environment is critical to successful operations at WSSU. The university will continue to collaborate with designers, contractors, and staff to improve energy efficiency of existing buildings through renovations. In the design and construction of new facilities the university will attempt to adhere to GS. 143-64.12 and continue to work towards the goals mandated within. To achieve the goal, replacement of HVAC systems, monitoring through the campus BAS, the change out of fluorescent lamps with LED bulbs or installation of thermostats with limited in room control are our objectives.

Energy Conservation Requirements

SB668 (GS 143-64.12) mandated that UNC System schools achieve a 30% reduction in BTUs/Sq. Ft by 2015 from a 2002-03 baseline year. While 30% goal was not an individual goal for each institution, the UNC System met the overall goal. To date, WSSU has achieved a 17% reduction from the 2002-03 baseline year as stated in the statute. Governor Cooper's Executive Order

80 released in October 2018 mandates a 40% reduction in BTUs/Sq. Ft for Cabinet Agencies only. Although Executive Order 80 does not specifically apply to the UNC system, it states that "North Carolina state owned facilities will strive to meet the goal by 2025. Currently, a bill has passed the house (HB330) that would incorporate the 40% goal of the Executive Order into GS 143-64.12 making it a statutory requirement for the UNC System if passed.

It is noted that the UNC System Policy Manual section 600.6.1 states: *The University of North Carolina ("The University") is committed to leading the State of North Carolina as an environmental steward that endeavors to proactively and effectively manage its impact on energy, water and other natural resources. Further, The University is obligated to ensure full compliance with all applicable local, state, and federal environmental laws and regulations. Therefore, it is the policy of The University's Board of Governors (the "Board") that The University, including General Administration, the constituent institutions, and affiliated entities, shall establish sustainable development and resource management, or "sustainability" as a core value of institutional operations, planning, capital construction, and purchasing practices.*

Energy and Water Consumption

During the 2021-22 fiscal year total utility expenditures amounted to approximately $3,420,000. During the same period WSSU purchased 29,605,489 kWh of electricity at a cost of $1,718,673; 1,460,964 therms of natural gas at a cost of $146,457; and WSSU purchased 42,333 gallons of #2 fuel oil at a cost of $ 95,267. Water consumption for the university was in the amount of 45,592 gallons at a cost of $420,349. To date WSSU has achieved a 2% reduction in BTUs per square foot. The university continues to address steam leaks that are due to an old system. There have been several leaks made in the recent past, but the new piping and repairs have shifted the steam to other areas that have caused pipes and valves to fail causing a loss steam which translates to loss of energy and dose not assist with the reduction of energy and costs. Due to the age and condition of equipment the campus is faced with the difficulty of energy reduction. The replacement of boiler number one and addition of a new chiller anticipated to occur in 2023 is a plan to increase some energy savings and cost reductions.

Implementation

As the university struggles with and shortage of staffing in the Design & Construction and Facilities Operations departments the university will attempt to continue to develop procedures and processes that concentrate on energy use reduction, water conservation, and sustainability. A challenge that the university has is the lack of a position of a Sustainability Director that can devote at least 75 % of her or his time to energy use reduction and water conservation. Employing a Sustainability Director will allow a concentrated effort of educating students, faculty, and staff on measures that can yield reductions in energy usage and the university's carbon footprint. Currently the Facilities Management Department contributes to sustainability by reminding the campus community of turning off lights when spaces are not occupied, using bottle fill drinking fountains, and reminding the Team Members not to leave vehicles idling, are measures that will assist with the reduction of our carbon footprint. Upon filling vacant positions, D&C will make a concerted effort to continue to work with the State Energy Office to explore ways to enhance energy conservation on campus and to stay abreast of best practices.

WSSU will maximize opportunities to derive benefits from the 2010 Guaranteed Energy Savings Performance Contract (PC) with Siemens. Staff will work with Siemens, to ensure that the maximum energy is conserved that is planned to provide costs avoidance. In conjunction with Siemens Performance Contract, D&C will collaborate with designers and vendors to correct any equipment that may need attention to function properly because of the time that has passed since the equipment has been installed.

KEY PERFORMANCE INDICATORS

		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
2017-18	Winston Salem State University	$516,697	$1.36	$12.74	26%	106,567	-17%	$841,308	$9.28	294%	32.04	-60%
2018-19	Winston Salem State University	$483,977	$1.30	$12.04	19%	107,560	-16%	$948,783	$9.16	289%	27.13	-66%
2019-20	Winston Salem State University	$474,883	$1.17	$10.97	8%	106,990	-17%	$929,613	$8.22	249%	24.94	-69%
2020-21	Winston Salem State University	$355,066	$1.11	$9.99	-1%	110,837	-14%	$1,132,301	$9.47	302%	21.73	-73%
2022-22	Winston Salem State University	$73,166	$1.49	$11.86	17%	125,399	-2%	$1,085,741	$9.22	291%	22.60	-72%

FOCUS AREAS

Focus Area 1 - Energy Data Management

2022-2023 Planned Activity
The university will continue to update its established Excel spreadsheets for collecting and analyzing monthly energy billing information. This effort is designed to enhance the evaluation of energy usage variations and to assist in determining the corrective action required.

Responsible: Administrative Assistant, Project Managers
Funding Source: Salary
Metric: All necessary data recorded and reviewed

2022-2023 Planned Activity
Investigate and have BAS updated for campus buildings.

Responsible: Project Manager
Funding Source: Salary and Repairs and Renovation Funds
Metric: Ensure that all building that are on the BAS can be controlled remotely.

Focus Area 2 – Outreach, Training, Communication

2022-2023 Planned Activity
Present the WSSU Strategic Energy Plan and energy usage to university Leadership.

Responsible: Project Manager, and Assistant Vice Chancellor
Funding Source: Salary
Metric: Presentation occurs

2022-2023 Planned Activity
Attend NC State University Energy Management Training Series

Responsible: Project Managers
Funding Source: Salary, State Energy Office (class & materials fees); WSSU (travel, lodging, and meals)
Metric: Passing the class

2022-2023 Planned Activity
Seek out opportunities for staff training by vendors

Responsible: Project Manager, Vendors
Funding Source: No cost
Metric: Presentations occurs

Focus Area 3 - Facility and Resiliency Projects

2022-2023 Planned Activity
Continue to repair and replace steam and condensate lines throughout campus.

Responsible: Project Manager, Contractor
Funding Source: Repairs and Renovations Funds
Metric: Steam pipes and condensate lines repaired or replaced

2020-2021 Planned Activity
Continue to change existing exterior lights to energy efficient LED lamps

Responsible: Maintenance Department
Funding Source: Repairs and Renovation Funds
Metric: Change outs occur

APPENDIX 1

2020-2021 PLANNED ACTIVITY COMPLETION

Focus Area 1 - Energy Data Management Activity Completion

2021-2022 Planned Activity
The University will continue to update its established Excel spreadsheets for collecting and analyzing monthly energy billing information. This effort is designed to enhance the evaluation of energy usage variations and to assist in determining the corrective action required.

Results
Monthly energy information was collected, recorded in the Excel spreadsheet, and analyzed.

2021-2022Planned Activity
Investigate and have BAS updated for campus buildings.

Results
The university continues to contract with Siemens to assist with monitoring the BAS and make adjustments to ensure the system is properly functioning.

Focus Area 2 – Outreach, Training, Communication Activity Completion

2021-2022 Planned Activity
Identify an opportunity to communicate the Strategic Plan and energy usage to university Leadership with the help of the State Energy Office.

Results
Due to COIVD-19 and being short staffed this Planned Activity was not implemented.

2019-2020 Planned Activity
Attend NC State University Energy Management Training Series.
Results
Due to COIVD-19 and short-staffed Planned Activity was not implemented.

2021-2022 Planned Activity
Seek out opportunities for staff training by vendors.
Results
Facilities Operations HVAC Team Members receive continuous training from Siemens in concerning the campus BAS.

Focus Area 3 - Facility and Resiliency Projects Activity Completion

2021-2022 Planned Activity
Repair steam and condensate lines on campus.
Results Steam and condensate lines and valves at various locations on campus were repaired and replaced.

2021-2022 Planned Activity
Change existing exterior lights to energy efficient LED lamps.
Results A continuous effort is being made to replace exterior lights with more efficient LED lamps. Changing the lamps provides energy efficiency and safety measures by providing a brighter lighting.

Mandate for Energy Management

WSSU has not met the statuary goal of a 30% reduction of BTUs per square foot from the baseline fiscal year 2002-03 through 2015. Executive Order 80 requires a 40% reduction by 2025 for state owned buildings. In addition, the UNC System has a goal to be carbon neutral by 2050.

Energy and energy management must be recognized as a controllable operating expense wherein savings can result in funding being available for other program needs. If the energy management program is to be successful, all members of the Winston-Salem State University Community, Students, Faculty, and Staff, have important roles to play. Energy cost reduction must become a vital part of the University Strategic Energy Plan. WSSU will endeavor to achieve 104,000 BTUs per square foot by fiscal year 2020- 2021 from 2019-2020 baseline.

The attached plan outlines the activities required to reduce energy and water consumption to achieve the goals of the programs.

Assistant VC Facilities

DocuSigned by:
Constance Mallette
5AB5A1F1B9BA4DE...
VC Finance and Administration

DocuSigned by:
Elwood Robinson
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Chancellor

Appendix D

Executive Order No. 80

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State of North Carolina

ROY COOPER
GOVERNOR

October 29, 2018

EXECUTIVE ORDER NO. 80

NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY

WHEREAS, North Carolina residents deserve to be better educated, healthier, and more financially secure so that they may live purposeful and abundant lives; and

WHEREAS, N.C. Const. art. XIV, § 5 requires the conservation, protection, and preservation of state lands and waters in public trust; and

WHEREAS, North Carolina is well positioned to take advantage of its technology and research and development sectors, along with its skilled workforce, to promote clean energy technology solutions and a modernized electric grid; and

WHEREAS, public-private partnerships in North Carolina foster market innovations and develop clean energy technology solutions that grow the state's economy; and

WHEREAS, the effects of more frequent and intense hurricanes, flooding, extreme temperatures, droughts, saltwater intrusion, and beach erosion have already impacted and will continue to impact North Carolina's economy; and

WHEREAS, climate-related environmental disruptions pose significant health risks to North Carolinians, including waterborne disease outbreaks, compromised drinking water, increases in disease-spreading organisms, and exposure to air pollution, among other issues; and

WHEREAS, to maintain economic growth and development and to provide responsible environmental stewardship, we must build resilient communities and develop strategies to mitigate and prepare for climate-related impacts in North Carolina.

NOW, THEREFORE, by the authority vested in me as Governor by the Constitution and the laws of the State of North Carolina, **IT IS ORDERED**:

1. The State of North Carolina will support the 2015 Paris Agreement goals and honor the state's commitments to the United States Climate Alliance.

   The State of North Carolina will strive to accomplish the following by 2025:

   a. Reduce statewide greenhouse gas emissions to 40% below 2005 levels;
   b. Increase the number of registered, zero-emission vehicles ("ZEVs"; individually, "ZEV") to at least 80,000;
   c. Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels.

2. Cabinet agencies shall evaluate the impacts of climate change on their programs and operations and integrate climate change mitigation and adaptation practices into their programs and operations. Council of State members, higher education institutions, local governments, private businesses, and other North Carolina entities are encouraged to address climate change and provide input on climate change mitigation and adaptation measures developed through the implementation of this Executive Order. Consistent with applicable law, cabinet agencies shall actively support such actions.

3. The Secretary or designee of each cabinet agency and a representative from the Governor's Office shall serve on the North Carolina Climate Change Interagency Council ("Council"), which is hereby established. The Secretary of the North Carolina Department of Environmental Quality, or the Secretary's designee, shall serve as the Council Chair. The North Carolina Department of Environmental Quality shall lead the Council by providing strategic direction, scheduling and planning Council meetings, determining the prioritization of activities, facilitating stakeholder engagement, and assisting in the implementation of pathways to achieve the goals provided in Section 1 of this Executive Order.

   The duties of the Council shall include the following:

   a. Recommend new and updated goals and actions to meaningfully address climate change;
   b. Develop, implement, and evaluate programs and activities that support statewide climate mitigation and adaptation practices;
   c. Establish workgroups, as appropriate, to assist the Council in its duties;
   d. Consider stakeholder input when developing recommendations, programs, and other actions and activities;
   e. Schedule, monitor, and provide input on the preparation and development of the plans and assessments required by this Executive Order;
   f. Review and submit to the Governor the plans and assessments required by this Executive Order.

4. The North Carolina Department of Environmental Quality ("DEQ") shall develop a North Carolina Clean Energy Plan ("Clean Energy Plan") that fosters and encourages the utilization of clean energy resources, including energy efficiency, solar, wind, energy storage, and other innovative technologies in the public and private sectors, and the integration of those resources to facilitate the development of a modern and resilient electric grid. DEQ shall collaborate with businesses, industries, power providers, technology developers, North Carolina residents, local governments, and other interested stakeholders to increase the utilization of clean energy technologies, energy efficiency measures, and clean transportation solutions. DEQ shall complete the Clean Energy Plan for the Council to submit to the Governor by October 1, 2019.

5. The North Carolina Department of Transportation ("DOT"), in coordination with DEQ, shall develop a North Carolina ZEV Plan ("ZEV Plan") designed to increase the number of registered ZEVs in the state to at least 80,000 by 2025. The ZEV Plan shall help establish interstate and intrastate ZEV corridors, coordinate and increase the installation of ZEV infrastructure, and incorporate, where appropriate, additional best practices for increasing ZEV adoption. DOT shall complete the ZEV Plan for the Council to submit to the Governor by October 1, 2019.

6. The North Carolina Department of Commerce ("DOC") and other cabinet agencies shall take actions supporting the expansion of clean energy businesses and service providers, clean technology investment, and companies with a commitment to procuring renewable energy. In addition, DOC shall develop clean energy and clean transportation workforce assessments for the Council to submit to the Governor by October 1, 2019. These assessments shall evaluate the current and projected workforce demands in North Carolina's clean energy and clean transportation sectors, assess the skills and education required for employment in those sectors, and recommend actions to help North Carolinians develop such skills and education.

7. Cabinet agencies shall prioritize ZEVs in the purchase or lease of new vehicles and shall use ZEVs for agency business travel when feasible. When ZEV use is not feasible, cabinet agencies shall prioritize cost-effective, low-emission alternatives. To support implementation of this directive, the North Carolina Department of Administration ("DOA") shall develop a North

Carolina Motor Fleet ZEV Plan ("Motor Fleet ZEV Plan") that identifies the types of trips for which a ZEV is feasible, recommends infrastructure necessary to support ZEV use, develops procurement options and strategies to increase the purchase and utilization of ZEVs, and addresses other key topics. DOA shall complete the Motor Fleet ZEV Plan and provide an accounting of each agency's ZEVs and miles driven by vehicle type for the Council to submit to the Governor by October 1, 2019, and annually thereafter.

8. Building on the energy, water, and utility use conservation measures taken pursuant to N.C. Gen. Stat. § 143-64.12(a), DEQ shall update and amend, where applicable, a Comprehensive Energy, Water, and Utility Use Conservation Program ("Comprehensive Program") by February 1, 2019, and biennially beginning December 1, 2019, to further reduce energy consumption per gross square foot in state buildings consistent with Section 1 of this Executive Order. The Comprehensive Program shall include best practices for state government building energy efficiency, training for agency staff, cost estimation methodologies, financing options, and reporting requirements for cabinet agencies. DEQ and cabinet agencies shall encourage and assist, as requested, higher education institutions, K-12 schools, and local governments in reducing energy consumption. To achieve the required energy consumption reductions:

    a. By January 15, 2019, each cabinet agency shall designate an Agency Energy Manager, who shall serve as the agency point of contact.
    b. Each cabinet agency shall develop and submit an Agency Utility Management Plan to DEQ by March 1, 2019, and biennially thereafter, and implement strategies to support the energy consumption reduction goal set forth in Section 1 of this Executive Order. DEQ shall assess the adequacy of these plans and their compliance with this Executive Order.
    c. By September 1, 2019, and annually thereafter, each cabinet agency shall submit to DEQ an Agency Utility Report detailing its utility consumption, utility costs, and progress in reducing energy consumption.
    d. DEQ shall develop an annual report that describes the Comprehensive Program and summarizes each cabinet agency's utility consumption, utility costs, and achieved reductions in energy consumption. DEQ shall complete this report for publication on its website and for the Council to submit to the Governor by February 1, 2019, and annually thereafter beginning December 1, 2019.

9. Cabinet agencies shall integrate climate adaptation and resiliency planning into their policies, programs, and operations (i) to support communities and sectors of the economy that are vulnerable to the effects of climate change and (ii) to enhance the agencies' ability to protect human life and health, property, natural and built infrastructure, cultural resources, and other public and private assets of value to North Carolinians.

    a. DEQ, with the support of cabinet agencies and informed by stakeholder engagement, shall prepare a North Carolina Climate Risk Assessment and Resiliency Plan for the Council to submit to the Governor by March 1, 2020.
    b. The Council shall support communities that are interested in assessing risks and vulnerabilities to natural and built infrastructure and in developing community-level adaptation and resiliency plans.

10. DEQ shall prepare and manage a publicly accessible Web-based portal detailing the Council's actions and the steps taken to address climate-related impacts in North Carolina. Cabinet agencies shall submit data, information, and status reports as specified by the Council to be published on the portal. In addition, DEQ shall develop, publish on the portal, and periodically update an inventory of the state's greenhouse gas emissions that, among other things, tracks emissions trends statewide by sector and identifies opportunities for additional emissions reductions.

11. By October 15, 2019, and annually thereafter, the Council shall provide to the Governor a status report on the implementation of this Executive Order.

12. This Executive Order is consistent with and does not otherwise abrogate existing state law.

13. This Order is effective October 29, 2018 and shall remain in effect until rescinded or superseded by another applicable Executive Order.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the Great Seal of the State of North Carolina at the Capitol in the City of Raleigh, this the 29th day of October, in the year of our Lord two thousand eighteen.

Roy Cooper
Governor

ATTEST:

Rodney S. Maddox
Chief Deputy Secretary of State

Appendix E

General Statute Chapter 143-64.12, *Authority and Duties of the Department; State Agencies and State Institutions of Higher Learning*

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§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office a biennial written report of utility consumption and costs. Management plans submitted biennially by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.
(2) The cost of analyzing the projected energy savings.
(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.
(4) An analysis that identifies projected annual energy savings and estimated payback periods.

(a1) State agencies and State institutions of higher learning shall carry out the construction and renovation of facilities in such a manner as to further the policy set forth under this section and to ensure the use of life-cycle cost analyses and practices to conserve energy, water, and other utilities.

(b) The Department of Administration shall develop and implement policies, procedures, and standards to ensure that State purchasing practices improve efficiency regarding energy, water, and other utility use and take the cost of the product over the economic life of the product into consideration. The Department of Administration shall adopt and implement Building Energy Design Guidelines. These guidelines shall include energy-use goals and standards, economic assumptions for life-cycle cost analysis, and other criteria on building systems and technologies. The Department of Administration shall modify the design criteria for construction and renovation of facilities of State buildings and State institutions of higher learning buildings to require that a life-cycle cost analysis be conducted pursuant to G.S. 143-64.15.

(b1) The Department of Administration, as part of the Facilities Condition and Assessment Program, shall identify and recommend energy conservation maintenance and operating procedures that are designed to reduce energy consumption within the facility of a State agency or a State institution of higher learning and that require no significant expenditure of funds. Every State agency or State institution of higher learning shall implement these recommendations. Where energy management equipment is proposed for any facility of a State agency or of a State institution of higher learning, the maximum interchangeability and compatibility of equipment components shall be required. As part of the Facilities Condition and Assessment Program under this section, the Department of Administration, in consultation with the State Energy Office, shall develop an energy audit and a procedure for conducting energy audits. Every five years the Department shall conduct an energy audit for each State agency or State institution of higher learning, and the energy audits conducted shall serve as a preliminary energy survey. The State Energy Office shall be responsible for system-level detailed surveys.

(b2) The Department of Administration shall submit a report of the energy audit required by subsection (b1) of this section to the affected State agency or State institution of higher learning and to the State Energy Office. The State Energy Office shall review each audit and, in consultation with the affected State agency or State institution of higher learning, incorporate the audit findings and recommendations into the management plan required by subsection (a) of this section.

(c) through (g) Repealed by Session Laws 1993, c. 334, s. 4.

(h) When conducting a facilities condition and assessment under this section, the Department of Administration shall identify and recommend to the State Energy Office any facility of a State agency or State institution of higher learning as suitable for building commissioning to reduce energy consumption within the facility or as suitable for installing an energy savings measure pursuant to a guaranteed energy savings contract under Part 2 of this Article.

(i) Consistent with G.S. 150B-2(8a)h., the Department of Administration may adopt architectural and engineering standards to implement this section.

(j) The State Energy Office shall submit a report by December 1 of every odd-numbered year to the Joint Legislative Energy Policy Commission, the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division describing the comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning required by subsection (a) of this section. The report shall also contain the following:

(1) A comprehensive overview of how State agencies and State institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains.

(2) Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed.

(3) A summary of the State agency and State institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section.

(4) A list of the State agencies and State institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the State agencies and State institutions of higher learning that received an energy audit.

(5) Any recommendations on how management plans can be better managed and implemented. (1975, c. 434, s. 3; 1993, c. 334, s. 4; 2000-140, s. 76(f); 2001-415, s. 3; 2006-190, s. 12; 2007-546, s. 3.1(a); 2008-198, s. 11.1; 2009-446, s. 1(e); 2010-31, s. 14.3; 2010-196, s. 2; 2013-360, s. 15.22(p); 2014-120, s. 55; 2015-241, s. 14.30(u); 2017-57, s. 14.1(f).)

Appendix F

Guidelines for the United States Department of Energy's Better Buildings Challenge

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Better Buildings CHALLENGE
U.S. DEPARTMENT OF ENERGY

Energy Data Tracking Manual

For Better Buildings Challenge Partners

U.S. DEPARTMENT OF ENERGY

The U.S. Department of Energy's (DOE) Better Buildings Challenge is a voluntary leadership initiative through which partners make a public commitment to achieve lasting, organization-wide energy savings. This ***Energy Data Tracking Manual for Better Buildings Challenge Partners*** documents the process that will be used for commercial, state and local government, education, multifamily, and data center partners to track and verify progress toward energy savings goals. A separate manual is available for industrial partners.

Contents

This manual will be updated as needed with the latest guidance and information from DOE.

Last Updated: January 12, 2021

Overview

Partners in the Better Buildings Challenge commit to achieve significant portfolio-wide energy savings established by a specific energy savings goal. Goals should encompass the entire portfolio and strive to achieve at least 20 percent energy savings over 10 years[1].

Partners will track and verify progress towards energy savings goals by following a common process, which is outlined below and detailed in this manual:

- **Baseline**: Progress will be tracked against a baseline year, which will be selected by partners within the parameters of program requirements.
- **Energy Tracking Software:** Partners are strongly encouraged, but not required, to use Portfolio Manager. Alternative data tracking options must be reviewed and approved by DOE.
- **Reporting**: Progress toward energy reduction goals will be tracked by DOE. Partners benchmarking in Portfolio Manager can share access to their account with DOE. All other partners will provide data to DOE in an approved reporting format. Data will be collected from partners at the building level.
- **Metrics:** Energy use metrics will be expressed in terms of source energy intensity.[2] For more information on metrics for different property types and example calculations, please refer to the Tracking Metrics section.
- **Verification:** Energy data and operating characteristics will be reviewed to ensure completeness and accuracy. Data may be independently verified for a random sample of partner properties to maintain integrity of program results.
- **Energy Performance Results:** Progress toward goals will be displayed for all partners in the Energy Performance section of the Better Buildings Solutions Center.

The following sections include details on how the energy data tracking process will be implemented. Partners may also choose to work with DOE to track and reduce water use across their portfolio. Details on the water tracking process are included in a separate guidance document.

Baseline Year

The preferred baseline year for the Better Buildings Challenge is the most recent calendar year for which data is available when a partner joins the program. A partner may choose any of the three most recent calendar years before the year the partner joined the Better Buildings Challenge, if it is considered important to capture recent energy savings accomplishments. For example, if a partner joined the Better Buildings Challenge in June 2013, the baseline year could be 2012, 2011, or 2010. The end date by which a partner will achieve the goal is generally set to be 10 years after the agreement date, or earlier as designated by the partner. In this example, the partner would have until 2023 to achieve their goal.

Partners provide energy consumption data for the baseline period to DOE in order to compute the baseline year energy use intensity. This data will include energy consumption and costs for all fuels, and floor area for all buildings. Specific energy data requirements depend on the energy data tracking software used.

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[1] Guidance on setting additional goals once the initial goal of 20 percent energy savings over 10 years has been met can be found in the “Setting New Goals” section.
[2] Source energy includes the energy used during transmission from the generation source to the building site. This value is calculated by Portfolio Manager. For more information, see www.energystar.gov/sourceenergy.

Portfolio-Wide Energy Data

Partners commit to achieve portfolio-wide energy savings, and will identify the portfolio of properties and associated energy data that will be covered by their commitment and shared with DOE. In order to reflect a comprehensive assessment across an organization, energy performance commitments should 1) encompass the entire portfolio of properties, 2) include whole-building energy data for all properties, and 3) include data for all fuels used at the properties. Additional details on program requirements are included below:

- Partners should include all buildings located in the United States. Partners should not report energy data from buildings outside the United States.
- Some partner organizations may have difficulty in defining their committed portfolio, based on ownership structures or availability of energy data. DOE is happy to work with partners as they develop their commitments. A portfolio may be defined as the set of buildings or sub-building spaces for which an organization manages, pays bills, and/or can report energy consumption. Note that for multifamily properties, partners are encouraged to obtain and rely on whole-building data. For partners with tenant-paid utility bills, additional guidance is included in **Appendix C**.
- Data for all fuel types (electricity, natural gas, steam, fuel oil, etc.) should be provided. If one fuel type represents a very small portion of the portfolio energy use, and partners have difficulty in obtaining data for that fuel type, it may be excluded. Contact DOE for additional details if this situation applies.
- Some partners own and operate facilities and energy consuming assets that do not fall under traditional commercial building categories (e.g., wastewater treatment plants, street lights, traffic lights). Partners are not required to include these property/asset types in their commitment, but may choose to do so. For partners that do include these property/asset types, more information is available in **Appendix D**. For partners that operate data centers, additional guidance is included in **Appendix E**.
- If partners operate on-site renewable electricity generation systems, the output from the systems that is used on site should be included as part of the partner's portfolio-wide energy data. It is important to include this energy use because it does represent energy consumed by the property. Regardless if a partner owns the renewable energy certificates (RECs) for the energy generated on site, the partner will receive credit for generating renewable electricity. All energy use is tracked in terms of source energy, and the conversions from site to source energy are lower for on-site renewable electricity than they are for grid-purchased electricity. For more information, see **Appendix F**.
- If partners operate electric vehicle charging stations, the electricity use for the charging stations may be excluded from the total property energy use reported, if the charging station use is separately metered.

Energy data will be shared with DOE at the building level.[3] In cases where building-level data is not currently available (e.g., universities with master-metered electricity or central heating plants, state governments with agency-level data), partners are encouraged to obtain data at the building level or install building-level metering if possible. More granular information can help organizations better identify opportunities to improve energy performance. However, data at the campus or agency level will be accepted.[4] Note that ENERGY STAR® guidance encourages tracking of energy use for certain building types, such as hospitals, at the

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[3] Note that building addresses will not be collected and building names will be kept confidential, except for buildings that are part of showcase projects.

[4] In the case where one or more facilities on a master meter intend to participate in the Better Buildings Challenge, but other facilities on that meter do not, DOE recommends the following approach. First, DOE encourages the partner to include all buildings on the master meter in the Better Buildings Challenge if possible. If this is not possible, the partner may include ALL usage from the master meter in the Better Buildings Challenge if the buildings included in the Better Buildings Challenge represent a large percentage of the energy usage from the master meter. Contact your Better Buildings Challenge account manager for additional details.

campus level. In these cases, Better Buildings Challenge guidance will be consistent with ENERGY STAR. In the descriptions of the reporting process that follow, the unit of tracking will be referred to as the “property,” which may consist of one or more “buildings.”

Energy Tracking Software

The use of Portfolio Manager for energy tracking is strongly encouraged. Portfolio Manager performs weather normalization and adjusted energy calculations to account for changes in operation over time, and allows for easy sharing of data with DOE. If a partner is not using Portfolio Manager, DOE can provide support to establish a Portfolio Manager account, upload property and energy use data, and share access with DOE. Data can be entered manually, through a spreadsheet upload option, or automatically through web services that exchange data directly. For more information, see www.energystar.gov/benchmark.

If a partner is using an alternative software tool for tracking energy data, DOE will work with the partner to review the tool to determine if it provides the required information and consistency in calculations for tracking progress. In order to determine this, partners are asked to submit a description of the tool used, as well as sample data illustrating that the tool generates all required reporting metrics. The description of the tool should include general information (tool name, tool developer, etc.) and answer the following questions:

- How does the tool annualize energy data?
- How does the tool calculate required energy intensity metrics? (Source energy use per square foot is used for most property types. See the Tracking Metrics section for alternative metrics that may be used.)
- How does the tool convert energy units to Site and/or Source energy?
- If applicable, how does the tool calculate weather-normalized energy use intensity?
- If applicable, how does the tool calculate adjusted energy use intensity? For what property characteristics is the energy use being adjusted?
- What checks are performed to ensure that data are complete and accurate?

Once the alternative tracking mechanism has been approved by DOE, the partner will submit energy consumption data every year using a Microsoft Excel spreadsheet template, available from DOE on request.

Reporting

Partners submit energy performance data to DOE, which will be used to document progress toward achieving energy reduction goals, and to recognize partners’ achievements. Many partners are tracking data on a frequent basis to guide energy management decisions. This is a best practice that can lead to energy and cost savings. DOE recognizes the time associated with reporting data to external parties, and as such, only requires an annual data submission for the Better Buildings Challenge. However, partners are encouraged to submit data in more frequent intervals. Partners who choose to submit data every six months are asked to make data submissions for the time periods ending in December and June, while partners who choose to submit data annually will submit data for the time period ending in December. Partner progress, either on annual or six month intervals, will be published on the program website.

For partners that are tracking energy consumption in Portfolio Manager, data can easily be shared with a DOE Portfolio Manager account, as described in **Appendix A**. If a partner is already tracking data in a Portfolio

Manager account, sharing data is a simple process. If a partner is new to using Portfolio Manager, DOE can provide assistance in setting up an account, entering data, and sharing access. By using the sharing feature in Portfolio Manager, DOE will automatically have read-only access to all updates made within Portfolio Manager, which simplifies the process for partners. Key energy performance data will be exported from Portfolio Manager using standard reporting formats for all partners. Partners will be notified before reports are generated so that they can confirm that data has been updated.

For partners that are using an alternative energy tracking software tool, data should be provided to DOE in a Microsoft Excel spreadsheet template, available from DOE on request. The Better Buildings Challenge Data Collection Template includes key metrics needed for tracking partner progress. It includes basic identifying information for properties (e.g., property name, ZIP code, property type, gross floor area) as well as annualized energy consumption data. The file includes instructions on how to enter data.

Tracking Metrics

Energy use metrics will be expressed in terms of source energy intensity. For typical commercial properties, energy use intensity (EUI) will be measured in terms of energy use per square foot.[5] Alternative energy intensity metrics may be used for different property types, as shown in **Figure 1** below. For partners that operate wastewater treatment plants, street or traffic lights, or other unusual property/asset types, refer to **Appendix D** for additional guidance. For partners that operate data centers, refer to **Appendix E** for additional guidance.

FIGURE 1: ENERGY INTENSITY METRICS

PROPERTY TYPE	ENERGY INTENSITY METRIC	DESCRIPTION
Commercial, Multifamily, Education	Source kBtu/square foot	Total annual energy use from all fuels at the property divided by total floor area
Data Center	Power usage effectiveness (PUE)	Total annual energy use from all fuels at the property divided by the total annual energy used by IT equipment
Food Service	Source kBtu/transaction	Total annual energy use from all fuels at the property divided by total annual transaction count
Street Lights	Source kBtu/light pole	Total annual energy use by all lights committed divided by the number of light poles
Wastewater Treatment Plants	Source kBtu/gallon of water treated per day	Total annual energy use at the plant divided by the annual gallons of water treated at the plant

Factors outside of partners' control, including occupancy and weather, often affect energy usage at a property. To better track true improvements in energy performance, the Better Buildings Challenge recommends using energy metrics that can adjust for the influence of these factors. For example, for partners sharing data in Portfolio Manager, adjustments will be made to energy use intensity values to account for variations in weather from year to year and changes in operating characteristics over time. At the property level, the following metrics will be used to track energy savings:

- **Adjusted EUI:** Adjusted EUI accounts for changes in operating characteristics over time, as well as changes in

[5] For the purposes of Better Buildings Challenge, the definition of square foot (and therefore energy use per square foot) will be consistent with Portfolio Manager. If alternative energy tracking software uses a different definition, it must be approved by DOE.

weather. For properties in Portfolio Manager, Adjusted EUI is provided for property types that receive an ENERGY STAR score.[6] It accounts for changes in operating characteristics that are included in the scoring model. These vary by space type, and may include factors such as hours of operation, number of workers, and number of personal computers. Additional details on Adjusted EUI are included in **Appendix B**. For properties that are not tracked in Portfolio Manager, partners may propose alternative procedures to adjust for changes in operating characteristics over time.

- **Weather-normalized EUI:** Weather-normalized EUI accounts for changes in weather from year to year. This metric is available for all property types in Portfolio Manager, and will be used for property types that do not receive an ENERGY STAR score. For properties that are not tracked in Portfolio Manager, weather normalization is commonly performed by alternative software tools. Guidance on weather normalization procedures is available from DOE on request.

DOE strongly encourages the use of Adjusted EUI for commercial property types that are eligible to receive an ENERGY STAR score. If a partner is not gathering the required operating characteristics to calculate this metric, default values provided in Portfolio Manager may be used to populate this information. Under these circumstances, adjustments in Portfolio Manager will only account for changes in weather.

Property level metrics will then be used to determine the following portfolio-level metrics, calculated for each partner:

- **Portfolio Average Baseline Energy Intensity:** This metric will be computed using an average of the individual property Baseline Energy Intensity values, weighted by the relevant intensity metric. (Note for partners using energy use per square foot that this is mathematically equivalent to the total energy use for the portfolio divided by the total square feet of the portfolio.) The Baseline Energy Intensity will include the properties in the portfolio during the baseline year.
- **Portfolio Average Current Energy Intensity:** This metric will be computed using an average of the individual property Current Energy Intensity values, weighted by the relevant intensity metric. The Current Energy Intensity will include the properties in the portfolio during the current year.
- **Percent Improvement in Portfolio Energy Intensity:** The Percent Improvement in Portfolio Energy Intensity will be calculated using the Portfolio Average Energy Intensity values, and will be used to track progress toward the partner's goal. It will be calculated for the total percent improvement since the baseline period (using the Baseline and Current Energy Intensity values).
- **Change in Percent Improvement from Previous Year:** This metric will be used to show progress on an annual basis. It is calculated by subtracting the Percent Improvement in Portfolio Energy Intensity for the previous year from the value for the current year.

Figure 2 shows an example calculation for a partner using energy use intensity (EUI) in terms of energy use per square foot. The calculation works similarly for all metrics. For partners that are using multiple energy intensity metrics for different property types, see **Appendix D** for additional guidance. For partners that operate central systems (e.g., heating or chiller plants, on-site electricity generation, combined heat and power generation), refer to **Appendix G** for additional guidance.

[6] Eligible property types that are currently represented by Better Buildings Challenge partners include office, K-12 school, hospital, retail, bank, hospitality, supermarket, warehouse, and residence hall.

FIGURE 2: COMPUTING PERCENT IMPROVEMENT IN PORTFOLIO EUI

The following example illustrates the process used to compute the portfolio EUI and percent savings, for a sample organization with three buildings – Building A, Building B, and Building C. The Portfolio Average Baseline EUI is computed as an average of the individual building Baseline EUI values (160, 140, and 170 kBtu/sq. ft.), weighted by the building floor area values, and is equal to 158 kBtu/sq. ft. This is equivalent to the total energy use of 71,000,000 kBtu for the portfolio divided by the total floor area of 450,000 square feet. The Portfolio Average Current EUI for Year 2 is 150 kBtu/sq. ft., following a similar process. The Percent Improvement in Portfolio EUI can then be calculated as:

$$\text{\% Improvement in Portfolio EUI} = \frac{\text{Baseline EUI - Current EUI}}{\text{Baseline EUI}} = \frac{\text{158 kBtu/sq. ft. - 150 kBtu/sq. ft.}}{\text{158 kBtu/sq. ft.}} = 5\%$$

	BASELINE			YEAR 1			YEAR 2		
Buildings	**Energy Use (kBtu)**	**Square Feet**	**EUI (kBtu/ sq. ft.)**	**Energy Use (kBtu)**	**Square Feet**	**EUI (kBtu/ sq. ft.)**	**Energy Use (kBtu)**	**Square Feet**	**EUI (kBtu/ sq. ft.)**
Building A	16,000,000	100,000	160	15,500,000	100,000	155	15,200,000	100,000	152
Building B	21,000,000	150,000	140	20,250,000	150,000	135	20,250,000	150,000	135
Building C	34,000,000	200,000	170	34,000,000	200,000	170	32,000,000	200,000	160
Corporate-wide	71,000,000	450,000	**158**	69,750,000	450,000	**155**	67,450,000	450,000	**150**
Percent Improvement in Portfolio EUI (From Baseline)						**2%**			**5%**
Change in Percent Improvement from Previous Year						**2%**			**3%**

Portfolio Changes

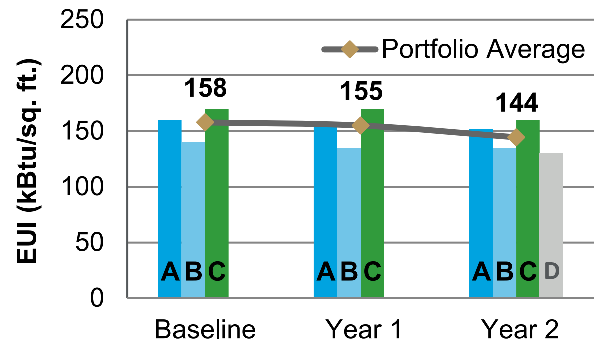
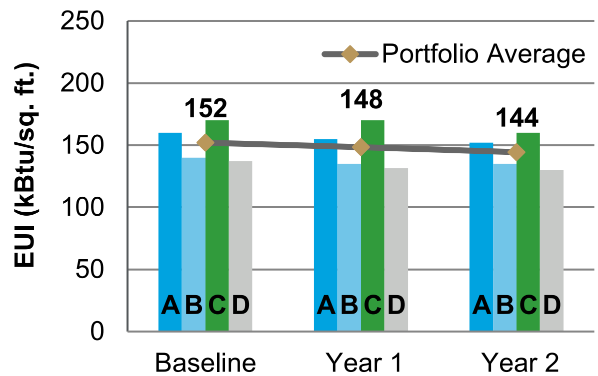
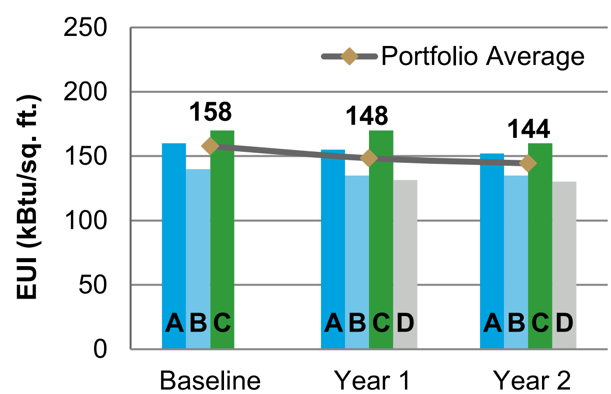
The portfolio of properties operated by a partner may change during the time period of the Better Buildings Challenge. If properties are removed from a portfolio, they will no longer be counted toward Better Buildings Challenge commitments. If properties are added to the portfolio, partners should add them to their commitment.

The policy for handling portfolio changes was designed to 1) encourage the inclusion of all new buildings in the corporate-wide commitment, 2) reward partners appropriately for building energy-efficient new construction, and 3) avoid unfairly crediting partners for shutting down or selling buildings.

As part of reporting energy consumption to DOE, partners should notify DOE of portfolio changes and report energy consumption data accordingly. For partners using Portfolio Manager, new properties can be added to Portfolio Manager, and shared with DOE.

Figure 3 below includes specific guidelines that apply to changes in a portfolio after the baseline year. Typical scenarios are presented, along with examples for each scenario. The examples use the sample organization described previously, which operates Buildings A, B, and C. The figures show how adding Building D or removing Building C will affect portfolio energy intensity calculations for the baseline period, Year 1, and Year 2.

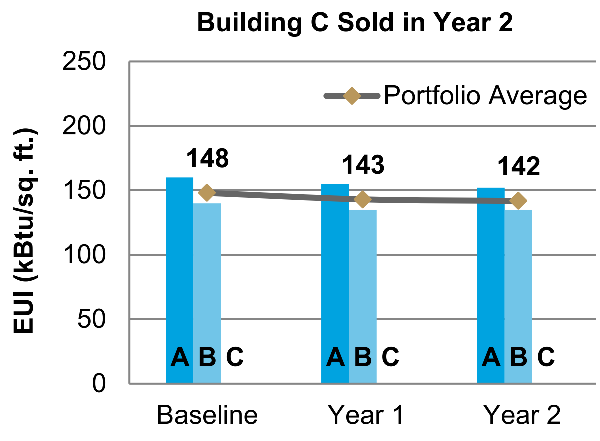
FIGURE 3: GUIDELINES FOR PORTFOLIO CHANGES

SCENARIO	EXAMPLE
New Construction: Properties added to the portfolio through new construction will be included in the current portfolio, but not in the baseline portfolio.[7]	**Building D Constructed in Year 2** 
Acquisition of Properties that Existed in the Baseline Year: It is recommended that partners obtain energy consumption data back to the baseline period if possible. Under these circumstances, the acquired properties will be included in the current portfolio and the baseline portfolio (as shown in the figure to the right). If data is not available for the baseline period, these properties will be included in the current portfolio, but they will not be included in the baseline portfolio (similar to the new construction figure shown above).	**Building D Acquired in Year 2** 
Acquisition of Properties that Did Not Exist in the Baseline Year: These properties will be included in the current portfolio, and can be included in any previous years in which they existed, but they will not be included in the baseline portfolio.	**Building D Acquired in Year 2, Built in Year 1** 

[7] Note that for New Construction and Acquisitions of properties that did not exist in the baseline year, a Baseline EUI will be established for the individual property using the first year it is added to the portfolio. This will not contribute to the portfolio Baseline EUI, but it will be used to demonstrate percent improvement over time for that individual property.

Removals: Properties removed from the portfolio (divestitures or closings) are no longer included in the current portfolio or the baseline portfolio. The baseline energy consumption will be re-calculated by DOE to exclude these properties.

For partners that have moved similar functions from one property to another or have consolidated multiple properties in to one central location, DOE will work with the partner to correctly account for changes.



As noted above, tracking the energy data for acquisitions to a portfolio is strongly encouraged. Exceptions are allowed for acquisitions of a limited nature. For any given year, if the sum of the energy use across all properties acquired in that year represents less than 5 percent of the total baseline energy consumption for a partner, the partner may choose to exclude these properties from the Better Buildings Challenge commitment.

The policy for handling portfolio changes is designed to accommodate portfolios that experience some changes over time, but that generally remain reasonably stable. However, some partners experience significant portfolio changes, including organizations that frequently buy and sell commercial real estate, and Community Partners that are experiencing rapid growth in program participation. Under these circumstances, it is difficult to compare a Baseline EUI and Current EUI for a portfolio, since the buildings included in the portfolio in each time period may be vastly different. DOE offers an alternative approach for these partners. Partners with high building turnover (typically greater than 5% of total committed square feet per year, on average) may choose to track the average annual percent improvement across their portfolio, rather than their cumulative percent improvement since a baseline period. Partners will commit to achieving at least 2% average annual improvement, which is consistent with 20% improvement over 10 years. The average annual percent improvement is computed for each property over the period it was held. The average annual percent improvement across the portfolio is then computed based on the individual values for each property, weighted by the baseline energy of each property. Under this approach, partners will share energy consumption data for all sold properties as well as currently held properties. Partners will also provide acquisition and disposition dates for all properties, and provide energy data through the date of disposition. Partners interested in this approach should contact DOE to review whether it is appropriate for their portfolio.

Verification

Verifying reductions in energy consumption is important to provide appropriate recognition for partners, publicize program-wide accomplishments, and ensure program integrity. The primary verification approach will be a data review to check for anomalies. Data verification will focus on property energy intensity and its components. Key fields subject to verification for most partners will therefore include square footage and current energy consumption for all fuels. For partners submitting Adjusted EUI data, additional fields may require verification if they deviate significantly from typical values (e.g., number of occupants, personal computers, walk-in coolers). If key data elements fall outside established error bands, DOE will follow up with partners and ask them to correct or explain anomalies in the data. Anomalies often take the form of missing energy consumption data, unit conversion errors, incorrect hours of operation, occupancy levels, etc. A document summarizing each "flagged" partner property and the data fields requiring completion or verification will be prepared by DOE and submitted to the partner. The partner will be asked to complete or update any missing data, as well as edit or confirm any other questionable data. From time to time, DOE may use a sampling approach to augment the above verification procedure and provide for independent verification. (That is, records would be sought from independent primary sources, such as utility bills directly from the supplier, to verify key data.) This sample-based verification approach may be implemented on a programmatic or partner-specific level.

Setting New Goals

Partners who achieve their initial Better Buildings Challenge goal can set a new goal to further improve energy performance. Partners are encouraged to strive for an additional 20 percent savings over a new 10-year period. The period should be selected so that it does not overlap the time period of the original goal. For example, if a partner achieved an initial goal in 2017, the new baseline period should be 2017 or later. Some flexibility in goal setting is allowed for prior goal achievers, in recognition of the success achieved to date. This includes the following:

- DOE may accept **a new goal of less than 20 percent savings** or over a period less than 10 years, particularly if the goal is aligned with other corporate goals. Partners should demonstrate that the new goal is ambitious, and represents continued leadership in energy performance. Goals that target at least 2 percent per year are encouraged.
- DOE will accept a **new goal with a time period that overlaps with the old goal period**, in order to align with other corporate goals.
- Partners may choose to **extend existing goals**. For example, a partner may increase a goal from 20 percent savings to 40 percent savings from the same baseline year. Partners may move the goal end date out to a later year, if desired. The overall goal should target at least 2 percent savings per year.
- DOE will consider **alternative calculation methodologies for energy savings goals**. For example, if partners are reporting energy use for other energy or environmental recognition programs, DOE may be able to use this data to track Better Buildings Challenge progress. Under these circumstances, DOE will perform a more limited review and verification of the facility-level results.

In addition to new energy savings goals, partners are encouraged to pursue goals associated with improving water performance. Details on water saving goals are included in Appendix H. Partners may also consider **alternative goals associated with improving energy and environmental performance**, in addition to a new energy savings goal. This may include goals for renewable energy, zero energy buildings, waste reduction, or other goals that contribute to reduced energy consumption (directly or indirectly) in commercial and industrial buildings sectors. Partners can work with DOE to identify appropriate metrics and recognition criteria.

Energy Performance Results

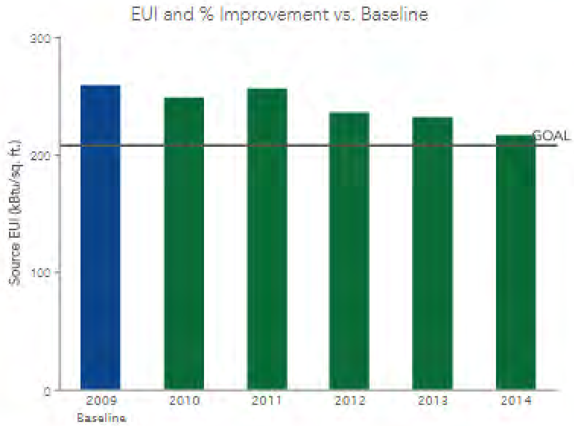
A key element of the Better Buildings Challenge is recognizing partners for their commitment to reducing energy use and transparently sharing information on the energy intensity of their portfolios and the progress toward their goals. Once energy data is collected and reviewed according to the procedures detailed in this manual, it is ready to be displayed on the Energy Performance section of the Better Buildings Solutions Center. Each partner has an individual page that includes the energy intensity improvement goal, the commitment in terms of square feet, and the progress toward the goal. Graphs are included with additional details on portfolio and property-level energy performance. The graphs follow a similar format for all partners, as shown in **Figure 4**. A number of graph templates are available for different partner types (e.g., commercial buildings, industrial plants, public sector partners with wastewater treatment plants). Partners work with DOE to develop a short narrative to accompany each graph, to tell the story of the partner's portfolio-wide energy savings accomplishments.

FIGURE 4: SAMPLE ENERGY PERFORMANCE RESULTS

Energy Performance

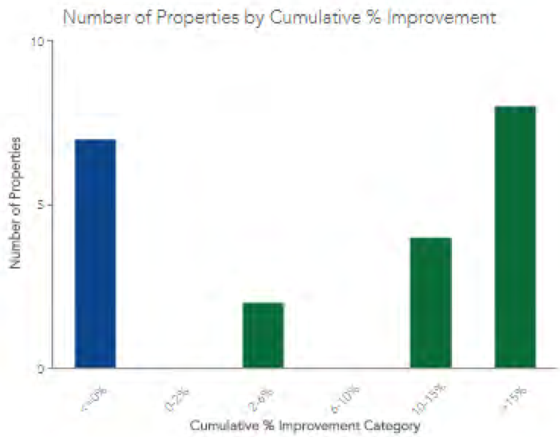
Cumulative (vs. Baseline)	16%
Annual (2014)	6%

Hillsboro OREGON



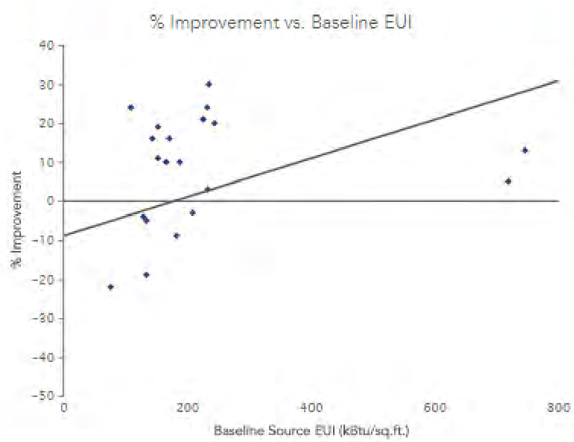
PORTFOLIO ENERGY PERFORMANCE

Better Buildings Challenge Partners strive to decrease portfolio-wide source energy use intensity (EUI) and to increase the percent improvement compared to a set baseline. Hillsboro's portfolio consists of more than 20 properties and 450 thousand square feet. Since 2009, Hillsboro has improved energy performance by 16%. Energy savings have been achieved by implementing a new Energy Management Plan that includes many lighting retrofits, HVAC and controls upgrades at the three largest properties, and an energy management policies awareness program focused on low-cost opportunities for savings.



ENERGY PERFORMANCE BY PROPERTY

Looking at the percent improvement in energy performance across all properties can provide insight into how an organization is saving energy. Hillsboro has achieved energy performance improvement at more than half of their properties. There are seven properties that have experienced an increase in Source EUI. These properties may be targeted for future energy efficiency improvements.



IDENTIFYING OPPORTUNITIES FOR IMPROVEMENT

Property-level energy performance metrics, including EUI and percent improvement to date, are critical to track progress over time and to identify opportunities for additional energy savings. Hillsboro's portfolio consists of properties with a wide range of baseline EUIs from 100 to 800 kBtu/sq. ft. The majority of properties have shown energy improvement since 2009. The properties located near or below the 0% axis may present good opportunities for further savings.

Appendix A – Portfolio Manager Sharing Instructions

If partners are using Portfolio Manager, they can automatically submit property-level data to DOE for program updates through the sharing feature within Portfolio Manager. DOE will communicate with partners two weeks in advance of each collection so that each partner can confirm the accuracy and completeness of data before it is submitted for the Better Buildings Challenge program. If a partner is not using Portfolio Manager, the Better Buildings Challenge program team can provide support to share property and energy use data.

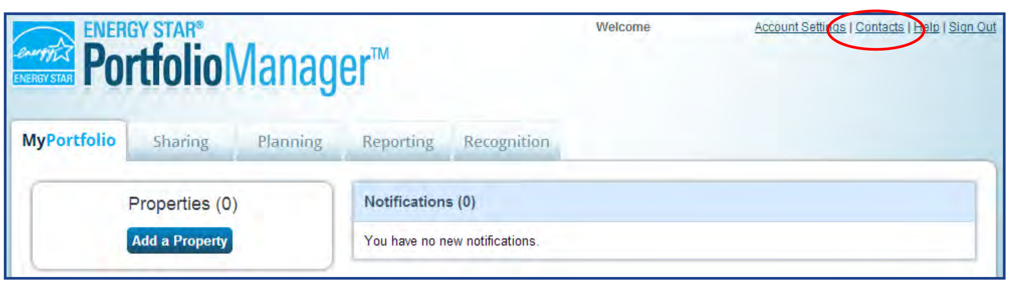
Below are two options for sharing energy data through Portfolio Manager.

- **Option 1** – **Share Properties:** Use Option 1 if you have created all properties within your own account or if all property managers and/or participating account holders are willing to share with the DOE-BBC-Account. See Option 1A (which follows Option 1) for instructions on how other users can provide Share Forward access to your account.
- **Option 2 – Shared Templates:** Option 2 is less favorable, but may be used to share custom template data within Portfolio Manager. Use this option if you are not able to share all properties with the DOE-BBC-Account.

As of September 2014, Portfolio Manager allows users to share properties that were shared with them from another user. The account holder that created the property, or Property Data Administrator, will need to provide other users with Share Forward Access. If properties were shared with you with Full Access before September 2014, the Property Data Administrator will need to edit your sharing access rights to grant you the ability to Share Forward. If properties were shared with you after September 2014 and you were granted Full Access, you will be able to share those properties with your DOE-BBC-Account. If your account contains properties that were shared with you before September 2014, you can ask the Property Data Administrator to either share the property directly with your DOE-BBC-Account (following the instructions in Option 1 below) or grant you Share Forward Access so that you may share them with the DOE-BBC-Account (following the instructions in Option 1A below). If you are not able to share all properties with the DOE-BBC-Account, you can share the necessary data from your account using Shared Templates outlined in Option 2.

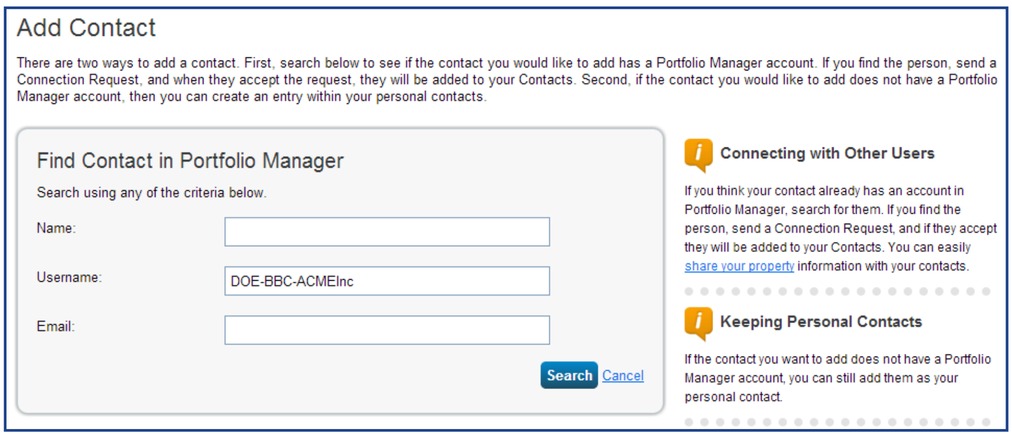
Option 1 – Share Properties

1. Log in to your Portfolio Manager account and locate the Contacts link on the top right corner of the page.

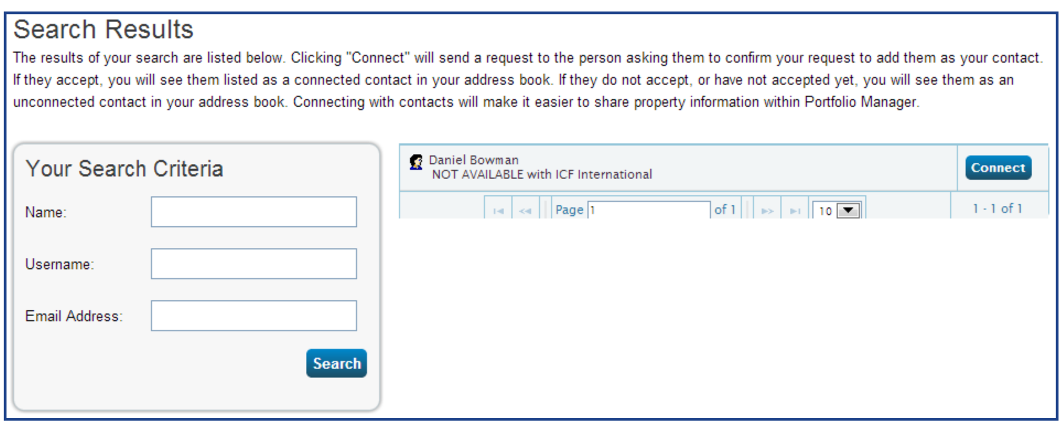


2. On the Contacts page, click the Add Contact button.

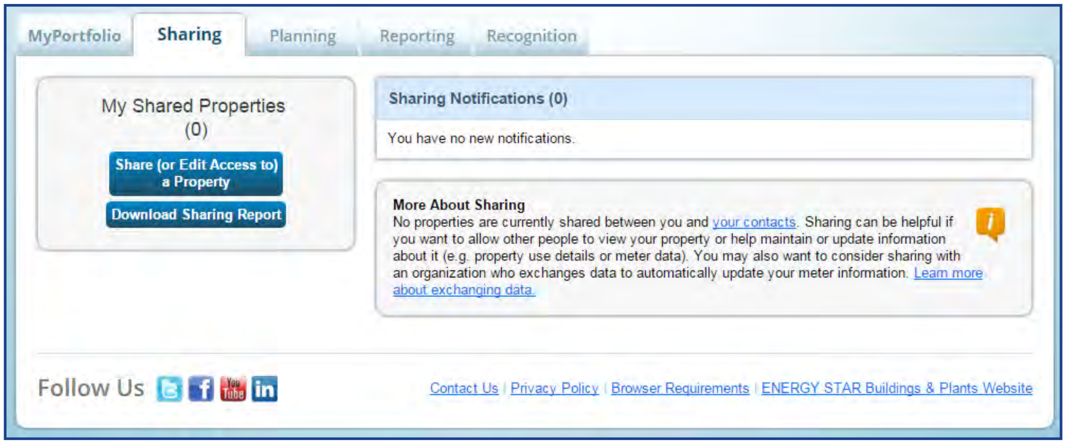
3. When you join the Better Buildings Challenge, you will be given the name of a Portfolio Manager account that will allow DOE to track your organization's energy use (Ex: "DOE-BBC-ACMEInc"). Enter the account name in the text box marked "Username:" in the Find Contact in Portfolio Manager section. Then click "Search."



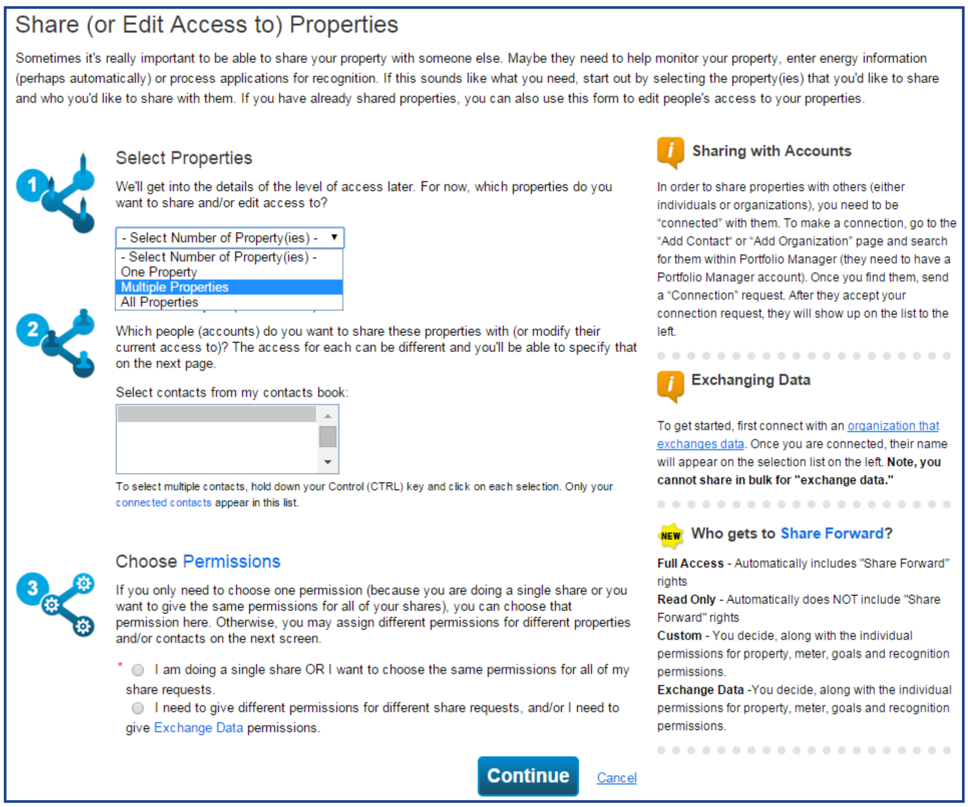
4. The DOE-provided account name will appear in the Search Results section on the next page. Click the Connect button. A notification will be sent to DOE. Once the connection request is accepted, you will be able to share properties with the Better Buildings Challenge.



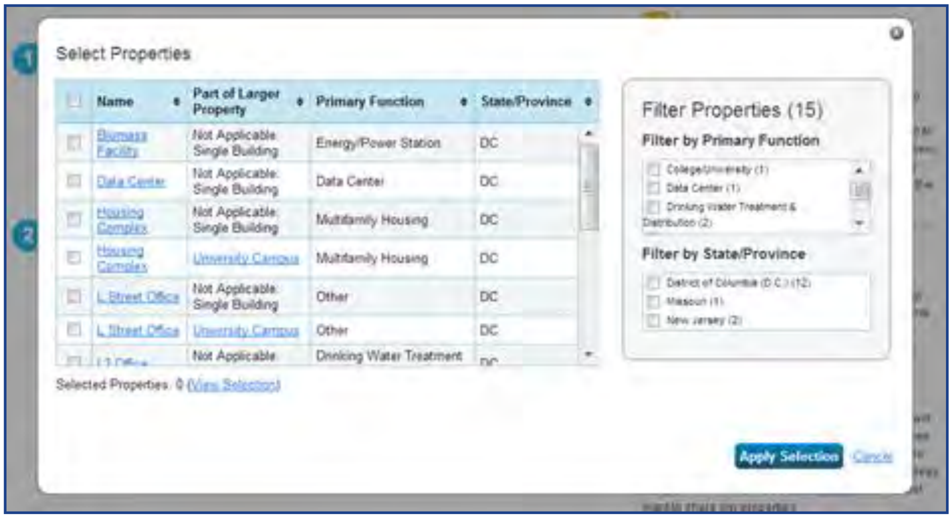
5. Once the connection has been made, click on the Sharing tab and then click Share (or Edit Access to) a Property.



6. Select the number of properties that you would like to share with the Better Buildings Challenge. It can be one, multiple, or all of the properties in your organization's Portfolio Manager account.

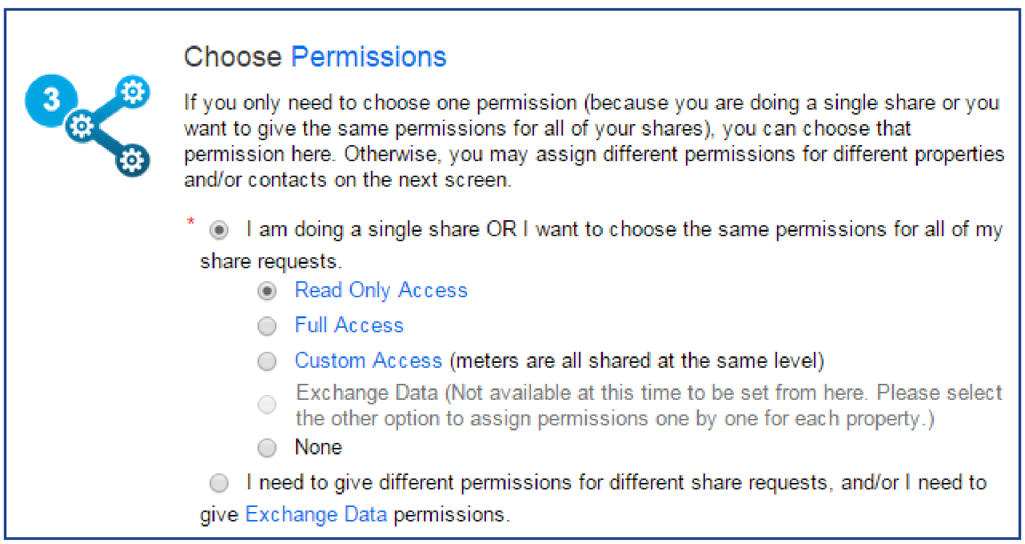


7. If you select the Multiple Properties option, you will see a Select Properties button. Click the button and choose the properties that you would like to share. You can filter the properties by type or location. Click Apply Selection.



8. Choose the account name provided by DOE in the Select People (Accounts) section.

9. In the Choose Permissions section, select “I am doing a single share OR I want to choose the same permissions for all of my share requests.” A new set of radio buttons will appear. Choose “Read Only Access.”

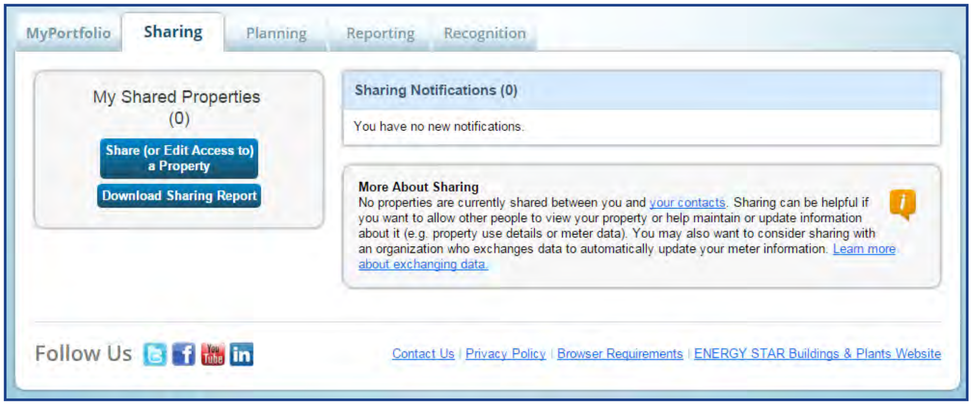


10. Select Share Properties to complete the share. You will receive a notification when your properties have been accepted by the Better Buildings Challenge.

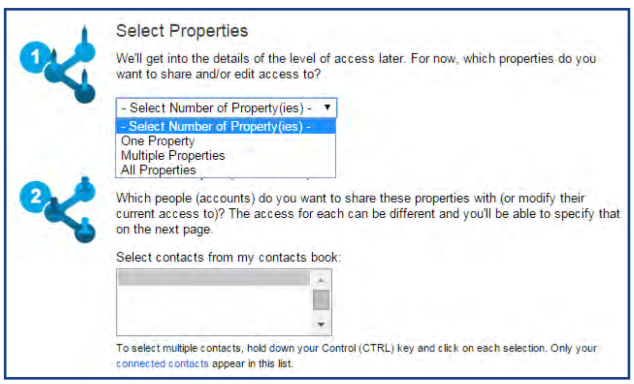
Option 1A – Request Share Forward Rights From Others

If you need to gain Share Forward rights to properties within your account, you can share the process below with the Property Data Administrators that created those properties.

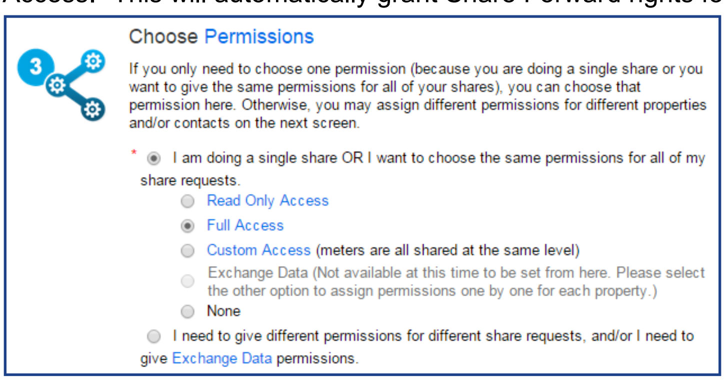
1. To share new properties or to edit existing sharing access rights, click on the Sharing tab and then click Share (or Edit Access to) a Property.



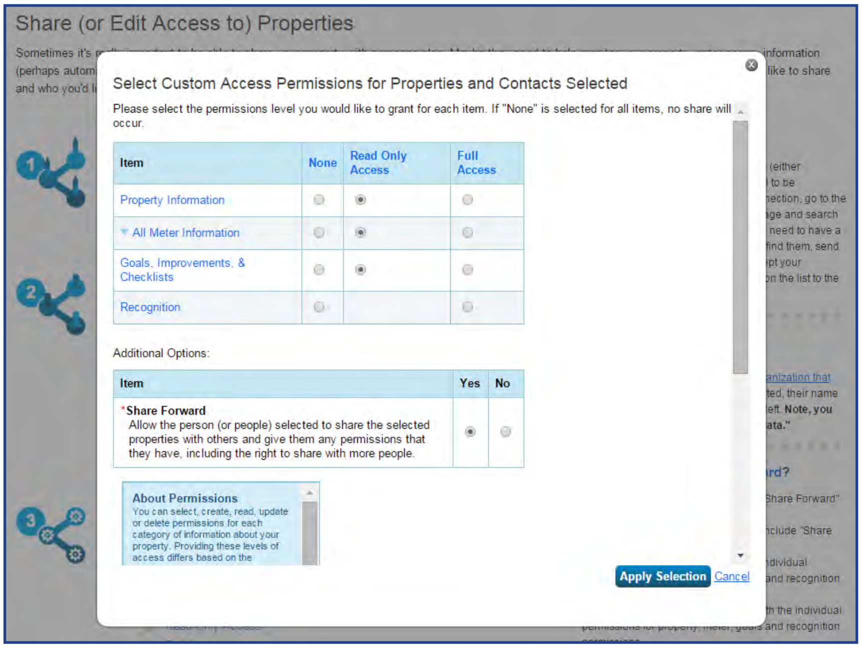
2. In step 1, select the number of properties that you would like to share or edit. It can be one, multiple, or all of the properties in your organization's Portfolio Manager account. In step 2, select the name of the contact that you are sharing with or editing access.



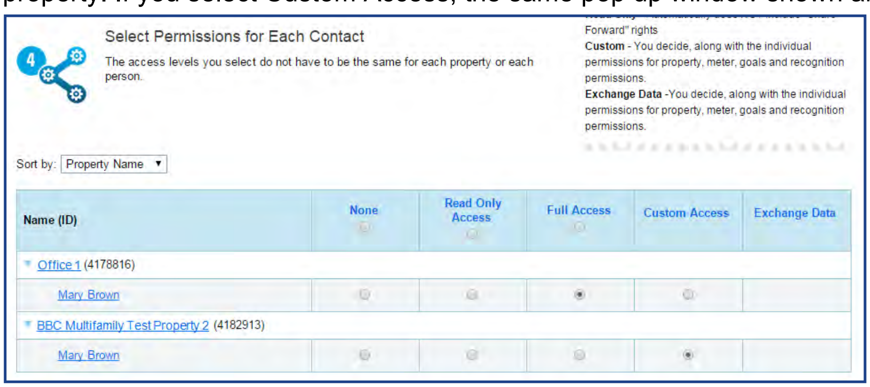
3. There are multiple options within step 3, the Choose Permissions section:
   a. If you would like to grant Full Access to all properties, select "I am doing a single share OR I want to choose the same permissions for all of my share requests." A new set of radio buttons will appear. Choose "Full Access." This will automatically grant Share Forward rights for all properties.



b. If you would not like to give Full Access (you do not want the other user to be able to edit your data), you can still grant Share Forward rights, by selecting Custom Access from the options shown above. When you select Custom Access, the pop up window shown below will appear. You can provide Read Only or Full Access to each property's Property Information, Meter Information, and Goals, Improvements, & Checklists. In order to allow for Share Forward rights, you must select Yes in the Share Forward option section.



c. Lastly, you can select "I need to give different permissions for different share requests, and/or I need to give Exchange Data permissions" from step 3. This will allow you to provide Full Access or Custom Access to all properties. Select Continue. Step 4, shown below, will allow you to select different permissions for each property. If you select Custom Access, the same pop up window shown above will appear.



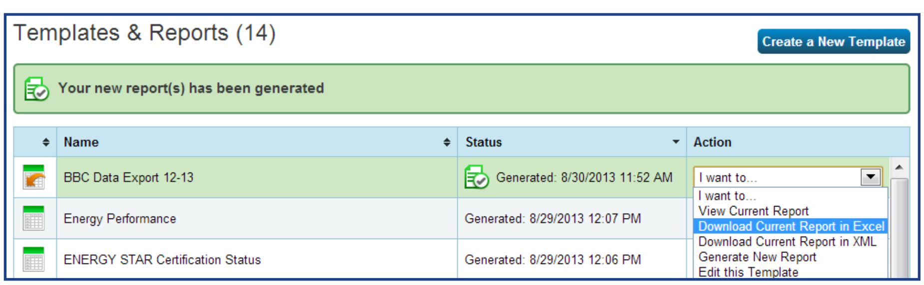
4. Select Share Property(ies) to complete the share. You will receive a notification when your properties have been accepted by the Better Buildings Challenge.

Option 2 – Shared Templates

If you are not able to share all of your organization's properties with your designated DOE-BBC Portfolio Manager account and you do not wish request Share Forward rights from other users, you can still provide data to the Better Buildings Challenge by generating custom templates. This will allow you to generate reports within your own account and send Portfolio Manager metrics to DOE. Follow the steps below to send your data to the Better Buildings Challenge.

1. Once you inform DOE that you would like to use the Data Template option, DOE will send a custom template to your Portfolio Manager account. To access the template, click on the Reporting tab and scroll down to the Templates & Reports table.
2. The shared template will automatically be loaded to the bottom of this table. To create a template, start by clicking Edit this Template from the "I want to…" drop down menu.

3. The timeframe and metrics to include will be pre-loaded for each shared template. Use the Select Properties to include drop down menu to choose the properties for which you would like to share data. Click Save Template.
4. This will take you back to the Reporting tab. From the same drop down menu for this report, select Generate New Report. This will automatically generate a report within Portfolio Manager. Once the report is created, the shared template will load at the top of the Templates & Reports table and be shaded in green. Click the "I want to…" drop down menu and select Download Current Report in Excel.



5. Once you have downloaded your report, you can edit any property information that you need in Excel and email the Excel spreadsheet to your Better Buildings Challenge account manager.

Appendix B – Portfolio Manager Adjusted EUI Calculations

For properties that are eligible to receive an ENERGY STAR score, Portfolio Manager performs adjustments to account for operating characteristics that have changed over time. Adjustments are calculated for operating characteristics that are included in the scoring model, which vary by property type, and may include hours of operation, number of workers, number of personal computers, etc. Using this approach, for example, a property could experience increased energy use due to longer hours of operation, but still show energy savings when the usage is adjusted to account for the longer operating hours.

To compute adjusted energy metrics for a property, Portfolio Manager uses a normalization factor generated from the scoring model for the relevant property type(s). The Predicted EUI for a property is computed under two different time periods of interest, to determine the normalization factor:

$$\text{Normalization Factor} = \frac{\text{Predicted EUI Current Period}}{\text{Predicted EUI Selected Period}}$$

The primary adjusted energy metric displayed in Portfolio Manager and therefore used for the Better Buildings Challenge, is the ***Source EUI – Adjusted to Current Period***.[8] The reference year for this metric is each property's current time period in Portfolio Manager. The energy use of all previous time periods is normalized relative to the current time period, based on the Normalization Factor. Therefore, changes in operating characteristics over time impact EUI values. Partners are encouraged to update operating characteristics to ensure accurate reporting for the Better Buildings Challenge.

For example, consider a partner that is using 2008 as the baseline year and has an office building that has a current time period of April 2015. When comparing the partner's baseline period (December 2008) to the current reporting period (December 2014) for this property, both the baseline and current EUI values for the Better Buildings Challenge are adjusted based on the property's operating characteristics in April 2015. If the office was operating at 100 hours per week in both December 2014 and April 2015, but only 50 hours per week in December 2008, the December 2008 adjusted source EUI value would be greater than the December 2008 source EUI value. The December 2008 adjusted EUI value shows the energy use the property would be expected to have consumed if it were operating 100 hours per week.

The Better Buildings Challenge will use the adjusted EUI values for all properties that are eligible to receive an ENERGY STAR Score. The weather normalized EUI value will be reported for all other property types. This metric computes the source energy use the property would have consumed under 30-year average weather conditions.

[8] The Adjusted EUI calculations performed and the metrics available in Portfolio Manager were updated in July 2013. Better Buildings Challenge metrics were updated to reflect these changes.

Appendix C – Multifamily Properties

Better Buildings Challenge multifamily partners work to track and reduce energy usage across their entire portfolio, including common area and tenant space for each of their properties. Obtaining this data can present challenges, depending on the metering and billing configurations at a given property. Common-area utility bills are generally paid by property owners or managers, and should be accessible. Utility bills for individual units can be paid by tenants, and therefore may be harder to obtain. This appendix addresses the special challenges associated with tenant-paid utility data for multifamily properties.

Collecting Energy Data

Partners can follow one of the approaches below to collect whole-building data for multifamily properties:

- **Master-metered properties:** Partners obtain all utility bills directly
- **Properties with tenant-paid accounts:** Partners obtain owner-paid bills directly (including common area use, owner-paid heating fuel use, etc.) and acquire data for tenant-paid accounts in one of the following ways:
    1. Obtain aggregated, whole-property tenant data from the utility
    2. Collect utility data for all tenant-paid accounts
    3. Collect utility data from a sample of tenant-paid accounts (see the Multifamily Sampling Protocol below)

For additional assistance with data collection, the HUD Multifamily Utility Benchmarking Toolkit and ENERGY STAR offer detailed guidance, valuable FAQs, and benchmarking resources.

Determining Energy Savings

Partners are encouraged to obtain and rely on whole-building energy data, as it is the best way to track and manage energy consumption, but it can be a challenge to obtain this data for an entire portfolio. Therefore, partner progress toward energy savings goals is determined using data for all properties, whether the property has whole-building energy data or only owner-paid utility data. Percent improvement in energy performance is calculated across the full portfolio. An average for properties with whole-building energy data and owner-paid energy data is determined, weighted by baseline energy use, as shown in the example below.

FIGURE C-1: PORTFOLIO PERCENT IMPROVEMENT CALCULATION

Property Type	Baseline Energy Use (kBtu)	Square Feet	Baseline Energy Intensity ($kBtu/ft^2$)	Current Energy Intensity ($kBtu/ft^2$)	Percent Improvement
Whole-building data	150,000,000	1,000,000	150	132	12%
Owner-Paid data	15,000,000	500,000	30	24	20%
Total	**165,000,000**				**13%**

Total Portfolio Percent Improvement

= Whole-building Percent Improvement * (Whole-building Baseline Energy / Total Baseline Energy) + Owner-paid Percent Improvement * (Owner-Paid Baseline Energy / Total Baseline Energy)

= 12% * 150,000,000 / 165,000000 + 20% * 15,000,000 / 165,000000

= 12% * 91% Whole-building Baseline Energy + 20% * 9% Owner-paid Baseline Energy

= **13%**

In order to be eligible to display energy savings results on the Better Buildings Solution Center, or to be eligible as a program goal achiever, the following data should be provided:

- Whole-building data for a minimum of 30% of a partner's committed square feet including:
  - All master metered properties (required)
  - All properties with access to utility provided aggregated whole building data (required)
  - Any properties where sampled tenant energy data has been collected
- Owner-paid data for remaining properties[9]

Obtaining Baseline Data

Many Better Buildings Challenge partners have made significant progress in obtaining whole building data, by collecting aggregated data from utilities or sampled data from tenants. However, partners are not always able to obtain whole-building data back to the baseline year for all properties, which presents another challenge to determining portfolio-wide energy savings for multifamily organizations. To address this challenge, partners may consider using the program's average annual percent improvement (AAPI) savings methodology, an approach that was designed for portfolios that experience significant change over time. Using this approach, the baseline year data for all properties is the first year with complete data. The average annual percent improvement across the portfolio is computed based on the individual percent improvement values for each property, from the relevant baseline for that property, weighted by the baseline energy use of each property. Contact your account manager to determine whether this methodology is appropriate for your organization.

Multifamily Sampling Protocol

Partners that are collecting utility data from a sample of tenant-paid accounts should follow the sampling protocol detailed below. As a companion to this guidance, the Multifamily Sampling Calculator spreadsheet tool may assist in determining requirements for sampling and calculating total energy usage. The HUD Multifamily Utility Benchmarking Toolkit provides additional tools and guidance to address sampling strategies.

1. **Determine the fuel types to be measured:** Sampling may be conducted for one or more fuel types at a property, depending on the billing configuration and data availability. If utility bills for a given fuel are tenant-paid, and energy use from the bills cannot be accessed through the utility or other means, partners should sample energy use. Sampling and extrapolated values may be calculated on a monthly or annual basis.
2. **Define the Sample Set:** To accurately reflect the energy usage of the property, sampled units should be representative of the range of units across the property.
   - **Determine the Level for Sampling:** Depending on the characteristics of the property being sampled, sampling may occur at different levels:
     - **Property Level:** If the buildings on the property share similar size, age, condition, and energy configuration, sampling at the property level is appropriate.
     - **Building / Building Type Level:** If a property's buildings have different sizes, ages, conditions, or energy configurations, then sampling at the building level may be appropriate. Buildings may be grouped into a single sample set if they are similar in size, age, condition, and energy configuration.

[9] A partner that does not have owner-paid data for the remaining properties is eligible for a partial data display, which includes only energy savings achieved at properties with whole-building data.

Examples of properties that may be sampled at the property level:
A single, 200-unit apartment building
A campus of 4 garden-style apartments
Two high-rise apartment buildings
Examples of properties that should be sampled by building/building type:
A campus with 2 mid-rise buildings and 8 townhouse buildings
A campus of 3 buildings, one of which has undergone extensive renovation

- **Account for Different Unit Types and Sizes:** Energy usage may vary between units based on the unit's characteristics. Partners are encouraged to sample a representative cross section of top floor, bottom floor, middle and corner units, and bedrooms. At the minimum, partners are encouraged to differentiate unit types by number of bedrooms.

3. **Determine the sample size and randomly select units:** Partners are encouraged to sample as many units as possible, in order to best represent the actual energy use for a property. **Figure C-2** provides a minimum threshold for sample size that should be met.[10]

   - **Determine the number of units to be sampled:** At the level of sampling that is required (i.e., property level or building level), count the total units and use the sampling guidance table to select a total sample number.

     If there is variation in unit types within the sample (e.g., multiple bedroom types within a property), the sample should be proportionally divided between unit types, rounding up.

     Example for sampling for different unit types: A 200-unit high-rise building consists of 150 one-bedroom units and 50 two-bedroom units. The minimum sample size according to the above guidance is 10 units. For unit-specific sample sizes, the recommended total sample is multiplied by the proportion of units in the building, rounded up, as shown in **Figure C-3** below.

FIGURE C-2: MINIMUM SAMPLE SIZE

TOTAL UNITS	SAMPLE (minimum)
5-9	2
10-19	3
20-29	4
30-49	5
50-74	6
75-99	7
100-149	8
150-200	9
>200	10

FIGURE C-3: EXAMPLE SAMPLE SIZE CALCULATION

	WHOLE PROPERTY	
Number of Units	200	
Recommended Sample Size	10	
	1-BEDROOM	**2-BEDROOM**
Number of Units	150	50
Proportion of Total	$\frac{150 \text{ (1 BR units)}}{200 \text{ (Total units)}} = .75$	$\frac{50 \text{ (2 BR units)}}{200 \text{ (Total units)}} = .25$
Recommended Sample Size (Rounding Up)	$10 * 0.75 \cong 8$	$10 * 0.25 \cong 3$

[10] The minimum unit sample size was calculated by DOE's Weatherization Assistance Program as part of their Multifamily Retrofit Tools and Workforce Resources. It was developed with industry input and review as part of their technical guidelines for multifamily building energy audits.

4. **Gather tenant data:** Given the challenges associated with obtaining tenant data, the Better Buildings Challenge recommends outreach to all tenants in order to collect as much data as possible. The procedure below to estimate whole property data normalizes the data received based on unit type. If outreach is only possible to a subset of units, the subset should be representative of the property as a whole and selected randomly.

   An effective tenant outreach strategy ensures that the utilities involved are satisfied with the method of authorization and the tenants are informed and comfortable with energy authorization. Partners are encouraged to work closely with utilities and tenants to ensure a smooth tenant outreach process. Sample energy authorization forms, as well as additional resources for gathering tenant data, are available at the HUD Multifamily Utility Benchmarking Toolkit. Better Buildings Challenge partners are encouraged to share their best practices for tenant outreach. For more information on sharing best practices, contact your Account Manager.

5. **Calculate Total Energy Use and/or Cost.** Approaches for extrapolating sampled data to the building and/or property level and totaling all energy usage are covered below.

   - **Extrapolating Total Energy Use for the Type Sampled:** Energy usage should be averaged for each unit type, then multiplied by the total number of units for each type (see table below):

FIGURE C-4: EXAMPLE OF CALCULATING UNIT AVERAGES

	1-BEDROOM	2-BEDROOM
Number of Units	150	50
# Units Sampled	18	6
Average Per Unit	Total energy use for sampled 1BR units / 18 = 102,000 kBtu/unit	Total energy use for sampled 2BR units / 6 = 156,000 kBtu/unit
Unit Type Total	$102{,}000\left(\frac{\text{kBtu}}{\text{unit}}\right) * 150 \text{ total units} = 15{,}300{,}000\ \text{kBtu}$	$156{,}000\left(\frac{\text{kBtu}}{\text{unit}}\right) * 50 \text{ total units} = 7{,}800{,}000\ \text{kBtu}$
Total Unit Energy	15,300,000 + 7,800,000 = 23,100,000 kBtu	

Note: *Energy usage is tracked for the Better Buildings Challenge in Source kBtus. In the calculations above, energy usage has already been converted to source kBtus. Sampling may also be done by fuel type and converted later.*

   - **Calculating Whole-Building Energy Use and Energy Intensity:** Once total tenant-area energy usage has been extrapolated, add owner-paid utility usage (e.g., electricity for common area and leasing office, exterior lighting, master-metered natural gas for heating). This may include energy usage for any relevant non-sampled spaces (e.g., a retail or restaurant space included as part of the property). To obtain energy use intensity, divide by the gross floor area of the property.

FIGURE C-5: CALCULATING WHOLE-PROPERTY ENERGY USE

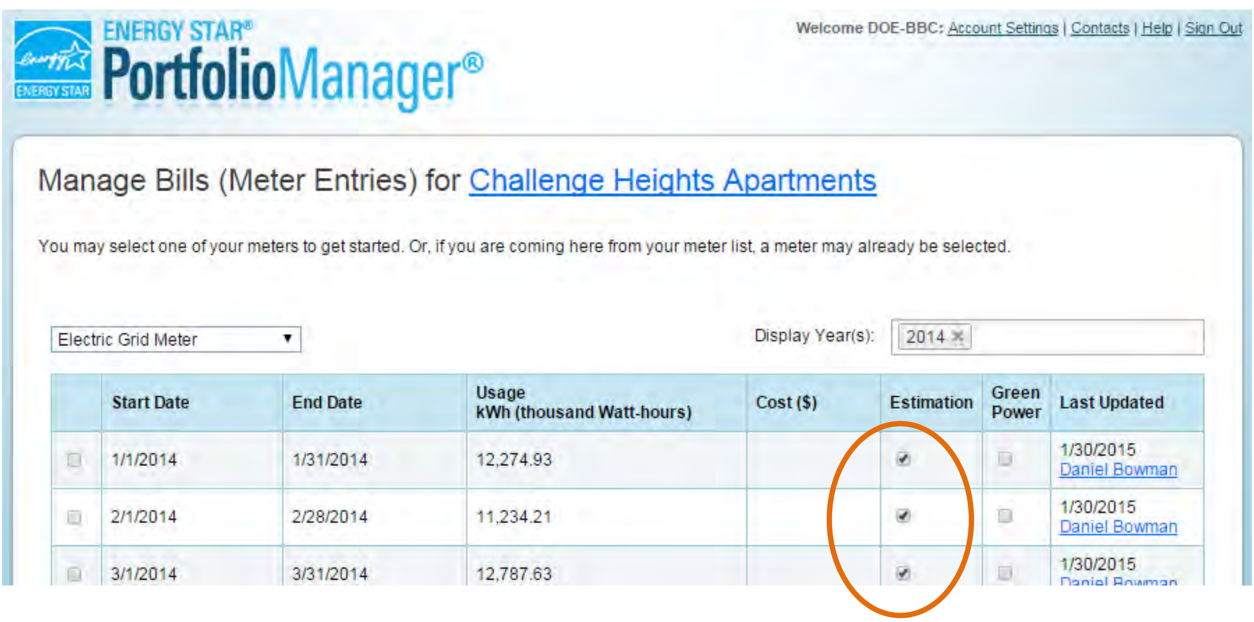
	METRICS FOR EUI CALCULATION
Total Unit Energy	23,100,000 kBtu
Total Owner-Paid Utilities	13,400,000 kBtu
Total Property Energy	36,500,000 kBtu
Property Floor Area	250,000 square feet

Property Energy Use Intensity	$\frac{36{,}500{,}000\ \text{kBtu}}{250{,}000\ \text{square feet}} = 146\ \frac{\text{kBtu}}{\text{square foot}}$

6. **Consider approaches for periodic sampling.** It is recommended that the same sample be evaluated for the baseline period and subsequent reporting periods, to the extent it is possible. If data is not available for certain units, they should be replaced with similar units from the population.

7. **Reporting energy performance.** Partners should collect energy usage data from all of the properties in their portfolio into a single database. Better Buildings Challenge partners are encouraged to use ENERGY STAR Portfolio Manager, or other energy benchmarking tools, to manage utility data and report results. Portfolio Manager provides a 1-100 ENERGY STAR score for eligible properties, which normalizes for changes in weather and operation. While properties that sample energy consumption data are not eligible for certification, the score may be used as a benchmarking tool for determining property energy performance. The tool also allows for easy sharing of data with the Better Buildings Challenge. Additional information about Portfolio Manager can be found in the 'Energy Tracking Software' section of the Data Tracking Manual.

   For each fuel type being sampled, partners should extrapolate the total tenant-paid utility use and enter it as a separate meter in Portfolio Manager. Partners should check the box marked "Estimation" to indicate that the data is sampled, as shown in the figure below.



Appendix D – Specialty Properties Guidance

Many Better Buildings Challenge partners own and operate properties and energy consuming assets that do not fall under traditional commercial building categories, which presents challenges in terms of tracking energy use per square foot. There are other types of properties for which alternative tracking metrics are approved or allowed. This appendix provides guidance for partners on how to track and report on energy use for Wastewater Treatment Facilities, Street Lighting, and Other Specialty Properties. It also outlines the methodology used to calculate percent energy reduction across a portfolio when these properties are included.

A number of different property/asset types that present unique data tracking challenges are presented below. Note that partners are not required to include these property/asset types in their Better Buildings Challenge commitment, but may choose to do so. The guidance below shows partners how to report energy use for each type. For some property/asset types, there may be multiple approaches that are acceptable. In this case, it is best to choose one approach and remain consistent over time.

Wastewater Treatment Plants and Water Treatment and Distribution Facilities

- **Partner Types:** These properties are generally associated with state and local government partners.
- **Data Entry Method:** Partners are encouraged to enter data into Portfolio Manager. Partners may also provide data through the Data Collection Template.
- **Energy Intensity:** Energy intensity may be expressed in terms of energy use per average flow rate. Partners should provide the average flow rate for each property. Energy intensity will be calculated in Portfolio Manager or the Data Collection Template.
- **Partner Square Footage Commitment:** The enclosed square footage of the property may be included in the Partner's commitment, but it is not tracked in Portfolio Manager. As a result, the portfolio floor area tracked by DOE may not match the partner's square footage commitment. This is considered acceptable as long as DOE and the partner have communicated regarding the reason for the difference.
- **Impact on Portfolio Energy Use:** Many water and wastewater treatment facilities use much more energy than buildings. In some cases, these property types can make up more than half of the energy use of the portfolio. We recommend utilizing technical assistance from DOE to understand the impacts of these facilities on portfolio energy savings before determining whether to include this property type in your portfolio.

Street Lighting

- **Partner Types:** Street lighting is generally associated with state and local government partners.
- **Data Entry Method:** Partners should provide data through the Data Collection Template. Portfolio Manager is not currently designed to handle street lighting.
- **Energy Intensity:** Energy intensity may be expressed in terms of energy use per pole. Partners should provide the number of poles. Energy intensity will be calculated in the Data Collection Template.
- **Partner Square Footage Commitment:** There is no square feet value associated with street lights, so they are not factored into the partner's commitment.

Parking Garages

- **Partner Types:** Parking garages are common across multiple property types.
- **Data Entry Method**: Partners may provide data using Portfolio Manager or the Data Collection Template.
- **Energy Intensity:** Energy intensity may be expressed in terms of energy use per square foot, but the square foot

will vary depending on how the property energy use is reported.

- A parking garage can be associated with a building in Portfolio Manager. This is recommended if the garage is not separately metered from the building. It can also be used if the garage is separately metered. In these cases, energy intensity for the garage and building is expressed in terms of energy use per square foot of the building (not including the garage).
- If a parking garage is separately metered from a building, or not associated with a building, it can be entered in Portfolio Manager as a stand-alone parking garage, with the space type as “Other – Other.” In this case, energy intensity is expressed in terms of energy use per square foot of the parking garage.

- **Partner Square Footage Commitment:** The square feet of the parking garage may be included in the partner’s commitment.
  - Note that if the parking garage is associated with a building, the square feet will not be included in many Portfolio Manager reports. If it is entered as “Other,” the square feet will be included. As a result, the portfolio floor area tracked by DOE may not match the partner’s square footage commitment. This is considered acceptable as long as DOE and the partner have communicated regarding the reason for the difference.

Open Parking Lots

- **Partner Types:** Open parking lots are common across multiple property types.
- **Data Entry Method**: Partners may provide data using Portfolio Manager or the Data Collection Template.
- **Energy Intensity:** Energy intensity may be expressed in multiple ways, depending on how the parking lot energy use is reported.
  - A parking lot can be associated with a building in Portfolio Manager. This is the most common scenario, and is generally recommended if the parking lot is not separately metered from the building. It is also a good approach if the partner wants to track energy use for a lot that is separately metered. In this case, energy intensity for the lot and building is expressed in terms of energy use per square foot of the building (not including the parking lot).
  - If the parking lot is separately metered from a building, or not associated with a building, partners can provide data through the Data Collection Template, similar to the approach for Street Lighting. If the number of poles is provided, energy intensity may be expressed in terms of energy use per pole.
- **Partner Square Footage Commitment:** The square feet of the parking lot should not be included in the partner’s commitment.

Traffic Lights

- **Partner Types:** Traffic Lights are generally associated with state and local government partners.
- **Data Entry Method**: Partners should provide data through the Data Collection template. Portfolio Manager is not designed to handle traffic lights.
- **Energy Intensity:** Energy intensity may be expressed in terms of energy use per traffic light fixture. Partners should provide the number of traffic light fixtures in the Number of Poles column in the Data Collection Template. Energy intensity will be calculated in the template.
- **Partner Commitment:** There is no square feet value associated with traffic lights, so they are not factored into the partner’s commitment.

Other (e.g., utility sheds, pump houses, bridge houses, park lighting)

- **Partner Types:** Challenging property/asset types may exist for all types of partners.

- **Data Entry Method:** If appropriate, partners are encouraged to enter data in Portfolio Manager. If it is not possible for a given property type, then the Data Collection Template should be used.
- **Energy Intensity:** If a square foot value is available (using footprint dimensions for an enclosed structure) and a reasonable use per square foot can be calculated, then energy use per square foot is the preferred metric. It may be the case that the EUI is much lower than other properties (e.g., for something like a utility shed), but if the property is included in the baseline and current periods, then computing energy use reductions based on the total portfolio EUI will still be appropriate. If other metrics (e.g., energy use per pole) would be appropriate, confer with DOE to see if the Data Collection Template can accommodate the metrics. If it is not possible to express energy use using an energy intensity metric (e.g., park lighting with no associated building), then the property/asset type should not be included in the Better Buildings Challenge.
- **Partner Square Footage Commitment**: If energy is being tracked in terms of energy use per square foot, and a reasonable square foot value is available, then it can be included in the partner's commitment.

To compute energy intensity improvement across the partner's portfolio, DOE will combine the following:

- Percent improvement in energy use per square foot for all properties with this metric.
- Percent improvement in energy use per average flow rate for all properties with this metric.
- Percent improvement in energy use per pole for all properties with this metric.

DOE will weight the percent improvement values for each group of properties, based on the baseline energy use for that group, which will generate an average percent improvement across the portfolio. An example portfolio percent improvement calculation is included below.

FIGURE D-1: PORTFOLIO PERCENT IMPROVEMENT CALCULATION

Property / Asset Type	Baseline Energy Use (kBtu)	Normalization Metric	Energy Intensity Unit	Baseline Energy intensity	Current Energy Intensity	Percent Improvement
Buildings	1,250,000,000	5 million sq. ft.	kBtu/sq. ft.	250	220	12%
Wastewater Treatment Plant	18,000,000	3,000,000 gallons/day	kBtu/gallons/day	6	5	17%
Street Lights	200,000,000	10,000 poles	kBtu/pole	20,000	16,000	20%
Total	**1,468,000,000**					**13%**

Total Portfolio Percent Improvement

= (12% * 1,250,000,000 + 17% * 18,000,000 + 20% * 200,000,000) / 1,468,000,000

= **13%**

Specialty property types that use a metric of energy use per square foot can usually be combined together to determine portfolio level energy use intensity as described in **Figure 2**, in the section on Tracking Metrics. However, if partners have specialty property types with EUI values that are significantly different than typical building EUI values (e.g., parking garages, stand-alone data centers), and if the amount of these specialty properties changes over time (through new construction or acquisition), it may be necessary to compute portfolio improvement using the approach described above. DOE will separate out the relevant group of specialty properties and calculate a percent improvement for both the buildings and the specialty properties. The percent improvement for both will then be weighted by total baseline energy to generate the average percent improvement across the portfolio. This calculation generally applies if a partner adds specialty properties that represent more than 10% of their baseline square footage (for low EUI properties such as parking garages) or more than 5% of their baseline energy use (for high EUI properties such as stand alone data centers).

Appendix E – Data Center Guidance

Data center energy use has grown rapidly in recent years and is expected to continue to grow. Data center properties are several times more energy intensive than typical commercial buildings on an energy use per square foot basis. Energy use per square foot for a data center can vary significantly based on the IT load, and is therefore not a meaningful measure of data center efficiency. The best available metric to track energy efficiency improvements in data centers is Power Usage Effectiveness (PUE), which is a measure of total data center energy use divided by IT energy use. For the purposes of understanding energy efficiency and identifying savings opportunities, DOE recommends that all data centers track performance using PUE.

Organizations participating in the Better Buildings Challenge may operate a few data centers within their portfolio, or may have a portfolio that consists primarily of data centers. For the purposes of tracking energy performance improvements toward Better Buildings Challenge goals, data centers will be handled as follows:

- **Partners that operate primarily commercial buildings:** These partners are encouraged, but not required, to include data centers in their portfolio. There are two options for tracking energy performance improvements toward a partner's Better Buildings Challenge goal:
  - EUI: Energy intensity can be tracked in terms of energy use per square foot for data centers. Data centers will be included in portfolio-wide savings calculations in the same manner as a typical commercial building. This is often appropriate if data centers represent a small portion of portfolio-wide energy consumption.
  - PUE: Energy intensity can be tracked using PUE for all data centers. The percent improvement from the organization's data centers will be combined with the percent improvement from other buildings using the methodology outlined in **Figure D-1** in **Appendix D**.
- **Partners that operate primarily data centers:** These partners will track energy intensity using PUE.

This appendix provides additional guidance for partners that are tracking energy performance using PUE.

Baseline

For data centers without existing energy meters (adequate to calculate PUE) where energy efficiency efforts or projects are planned in year one of participation in the partnership, an estimated baseline, or spot or temporary metered data (1 month minimum extrapolated to 1 year) may be used as baseline year energy information. The data will be reported in the same manner as the rest of the portfolio, but can be marked as estimated data.

An estimated baseline can be accomplished with the use of the IT and HVAC load estimating functions of the DC Pro data center project analysis and development tool, or an equivalent tool or method. Technical Account Managers (TAMs) with DOE's Data Center of Excellence will be available to assist in estimated baseline development. Data center efficiency efforts or projects that are initiated using an estimated baseline, or spot or temporary meter baseline method, must include permanent IT and infrastructure metering as part of the efficiency efforts or projects to track post project/process improvement performance against the estimated baseline.

Tracking Progress and Example Calculation

The Better Buildings Challenge measures data center progress based on the energy performance of the infrastructure (the "overhead" associated with cooling, power distribution, and lighting) associated with the data center(s). The industry-standard metric for data center energy performance is Power Usage Effectiveness

(PUE). PUE is the ratio of total data center energy to the IT energy. Variables used to calculate PUE will in turn be used to determine the ratio of data center energy used for infrastructure to the energy used by the information technology (IT) equipment. This infrastructure energy is equal to the PUE-1, i.e. the Power Usage Effectiveness minus 1. This metric shall be expressed as a decimal fraction; values can theoretically range from zero (no infrastructure energy used) to infinity, with typical values for real data centers ranging from 0.3 to 3. Organizations are encouraged to measure and track the overhead on a system-by-system basis to help identify and realize savings opportunities. Adjustments to account for changes in operation may be performed as necessary, supported by DOE guidance.

The facility-level energy metrics will be used to determine the portfolio-level metrics, which will be calculated for the partner by DOE:

- **Portfolio Average Baseline PUE-1:** This metric is computed by taking the baseline total energy use for all data centers and dividing that by the baseline total IT energy use for all data centers (the aggregated PUE) and then subtracting one. The Baseline PUE-1 will include the properties in the portfolio in the baseline year.
- **Portfolio Average Current PUE-1:** This metric is computed by taking the current total energy use for all data centers and dividing that by the current total IT energy use for all data centers (the aggregated PUE) and then subtracting one. The Current PUE – 1 will include the properties in the portfolio in the current year.
- **Percent Improvement in Portfolio PUE-1:** This metric will be calculated using the Portfolio Average PUE-1 values, and is the metric that will be used to track progress toward the partner's goal. This metric is reported for the total change since the baseline period.

FIGURE E-1: COMPUTING PERCENT IMPROVEMENT IN PORTFOLIO PUE-1

The example below illustrates the process used to compute the percent improvement in PUE-1 for a portfolio. The sample organization has three facilities – Data Centers A, B, and C. The Portfolio Average Baseline PUE-1 is computed as the total baseline energy use of 4,700,000 kWh divided by the total IT energy use of 2,300,000 kWh, and then subtracting 1, which is equal to 1.043. Following a similar process, the Portfolio Average PUE-1 for Year 2 is equal to 0.900. The Percent Improvement in Portfolio PUE-1 can then be calculated as:

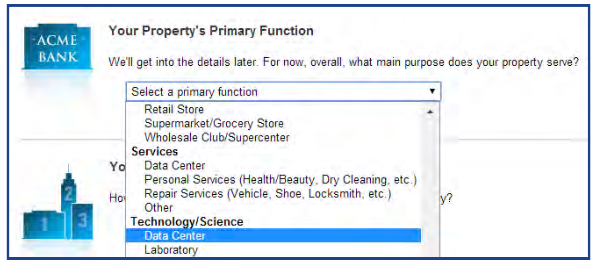
$$\% \text{ Improvement} = \frac{(\text{Baseline PUE - 1}) - (\text{Current PUE - 1})}{\text{Baseline PUE - 1}} = \frac{1.043 - 0.900}{1.043} = 14\%$$

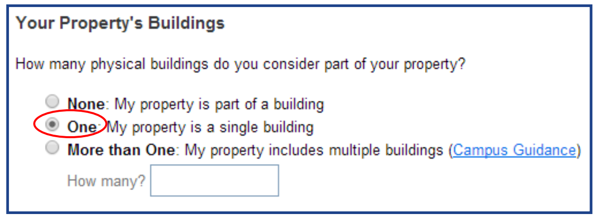
	BASELINE			YEAR 1			YEAR 2		
Data Centers	**Total Energy Use (kWh)**	**IT Energy Use (kWh)**	**PUE-1**	**Total Energy Use (kWh)**	**IT Energy Use (kWh)**	**PUE-1**	**Total Energy Use (kWh)**	**IT Energy Use (kWh)**	**PUE-1**
Data Center A	1,500,000	1,000,000	0.50	1,600,000	1,100,000	0.45	1,700,000	1,200,000	0.42
Data Center B	1,800,000	600,000	2.0	1,700,000	600,000	1.83	1,750,000	650,000	1.69
Data Center C	1,400,000	700,000	1.0	1,350,000	650,000	1.08	1,300,000	650,000	1.00
Corporate-wide	4,700,000	2,300,000	**1.043**	4,650,000	2,350,000	**0.98**	4,750,000	2,500,000	**0.90**
Percent Improvement in Portfolio PUE-1 (From Baseline)						**6%**			**14%**
Change in Percent Improvement From Previous Year						**6%**			**8%**

Portfolio Manager Data Center Portfolio Setup Guidance

Follow the steps below to create your data center portfolio and enter your energy consumption data. Visit energystar.gov/benchmark to log in or create a new account.

Creating Stand Alone Data Centers





1. Click Add a Property on the top left side of the MyPortfolio page to get started.

2. From the Set up a Property page, select Data Center from the dropdown menu in the Your Property's Primary Function section.

3. In the Your Property's Buildings section, select One: My property is a single building.

4. In the Your Property's Construction Status, select Existing and then click Get Started!

   On the Set up a Property: Basic Property Information page, fill in the Data Center's name, location, year built, and size. The Do Any of These Apply? questions are optional, but may help you set up the property in the coming steps. Select the check boxes for any that apply and click Continue. Note: You should not input a separate office space in your stand-alone Data Center if the office is used in support of the Data Center space.

5. The Set up a Property: How is it used? page asks you to enter the Data Center size and meter configuration. Enter the Gross Floor Area and choose the selections that apply for IT Energy Configuration, UPS System Redundancy, and Cooling Equipment Redundancy. The Current As Of date is automatically populated with the year that the building was built.

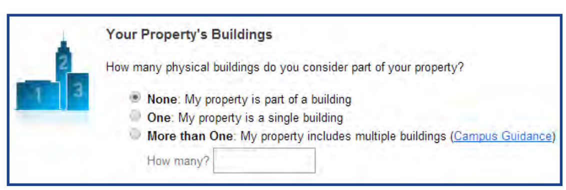
6. Select Add Property to finish the set up process.

Creating Data Centers Embedded in a Multiuse Building

(These should only be treated as a separate property if the organization does not own the entire building.)

1. Click Add a Property on the top left side of the MyPortfolio page to get started.

2. From the Set up a Property page, select Data Center from the dropdown menu in the Your Property's Primary Function section.



3. In the Your Property's Buildings section, select None: My property is part of a single building.

4. In the Your Property's Construction Status, select Existing and then click Get Started!

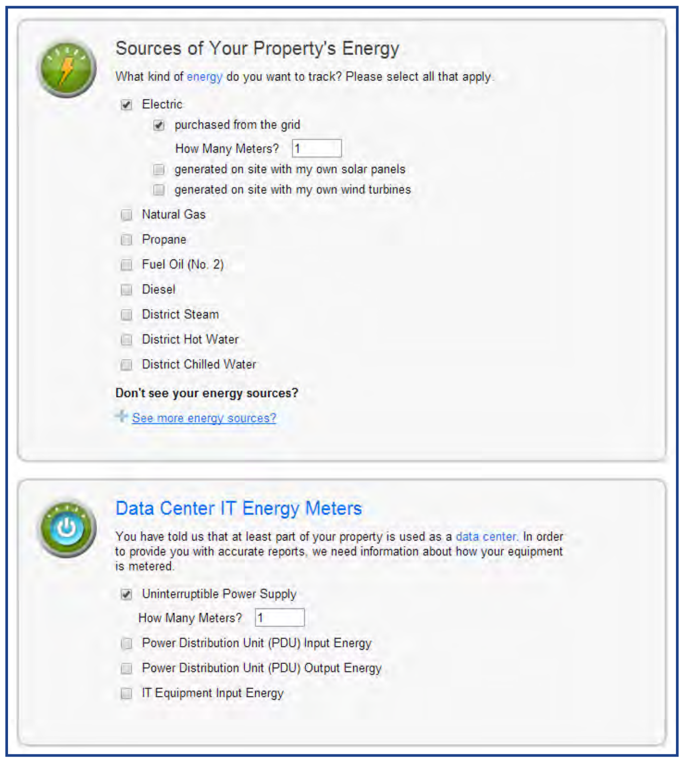
5. Follow steps 5 through 7 in the Create a Stand Alone Data Center section above.

Entering Total Data Center Energy and IT Energy

The data entry process for both Stand Alone Data Centers and Data Centers Embedded in Multiuse Buildings is identical. Once you have created your property in Portfolio Manager, you will be asked to add your energy use information. Click the add energy use information link in the green text box shown below. If you clicked away from this page for any reason and you no longer see the green text box, click on the Meters tab and then click Add Another Meter.

Total Energy Input

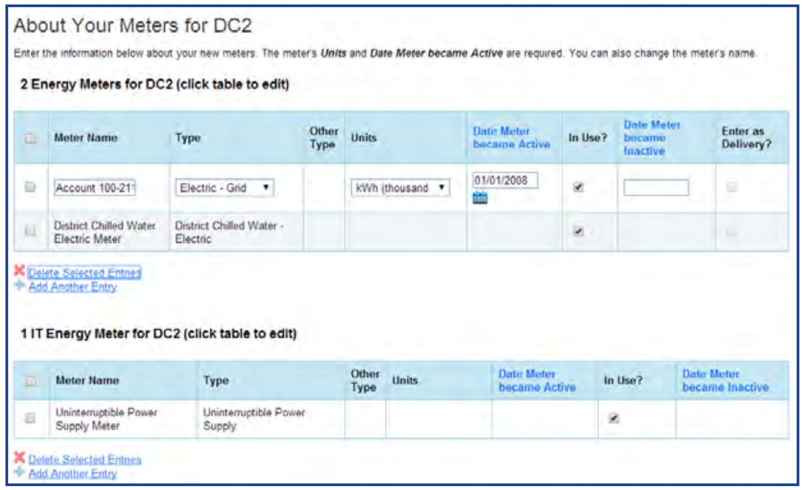
- Stand Alone – total energy in a Stand Alone Data Center is the energy used by the entire building. This includes office space supporting the data center, all data center infrastructure energy (HVAC, lighting, etc.) and the energy used by IT equipment.
- Embedded – total energy in an Embedded Data Center includes all data center infrastructure energy and energy used by the IT equipment. In order to include Embedded Data Centers in the Better Buildings Challenge, partners must have a submeter on both.



On the Sources of Your Property's Energy page, you will be asked the type and quantity of meters located at your property. Check all types that apply and enter the correct quantity of each type of meter. For Embedded Data Centers, this should include Data Center infrastructure meters – meters that support only the Data Center space, such as cooling loads, lighting, and any additional supporting loads – and IT energy meters. For Stand Alone Data Centers, this should include all energy meters at the property, including IT energy. If your data center receives chilled water, hot water, or steam from building systems, select the District Steam, District Hot Water, or District Chilled Water options. Within the District Chilled Water option, you will have the ability to choose whether the water is from an electric driven chiller, an absorption chiller using natural gas, an engine driven chiller using natural gas, or another type of chiller.

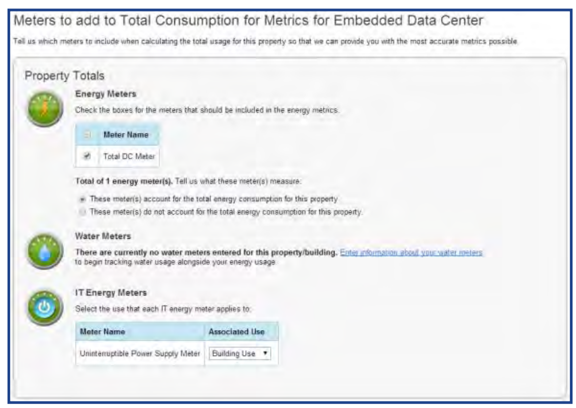
IT Energy Input

The page in the screenshot above also includes a section for Data Center IT Energy Meters. Select the correct meter type and enter the correct quantity of meters. The IT energy meter options are based on the location of the submeter within a data center. Most data centers have both an Uninterruptible Power Supply (UPS) and Power Distribution Units (PDU) located upstream from IT equipment. If the submeter is located at the output of the UPS, select the first option above. If the meter is located at the input or output of a PDU, select option two or three. If the meter is located at the input of the IT equipment, select the fourth option. Once you have made your selection, click Get Started!



On the About Your Meters page, you can change the name of your meters by clicking in the Meter Name cells. For non-utility meters, we suggest naming the meter as “submeter” or a name that is easy to remember and differentiate from other meters. The IT Energy Meters are located in the table below the Energy Meters. Enter the Units and Date Meter became Active for all meters that were created and click Continue.

You can then either enter individual monthly entries for your meters on the Your Meter Entries page or click Finish Meter Set Up. If you choose to finish the set up before entering monthly usage values, you will be able to enter usage information through the property’s Meter tab.



On the Meters to add to Total Consumption page, select the Energy Meters that should be used to calculate data center metrics. All meters are shown in the Meter Name table. Use the check boxes to select the meters that should be included when calculating PUE. For Embedded Data Centers, this list should include Data Center infrastructure energy and IT energy. In the IT Energy Meters section, choose the correct space associated with each IT meter. Click Apply Selections when completed.

Appendix F – Tracking and Entering Data for Renewable Energy

Is it necessary to track and report renewable energy for the Better Buildings Challenge?

Renewable energy should be separately reported for properties if all of the following apply:

- Renewable energy is generated *on site*. Renewable energy generated *off site* will reduce greenhouse gas emissions, but does not reduce energy consumption at the property, and therefore is not required to be reported.
- On-site renewable energy accounts for more than 5% of the total energy use of the building. Below this threshold, partners are encouraged to track and report renewable energy, but it is at the partner's discretion.

For more information on renewable energy, RECs, and conversion factors, see the Portfolio Manager Technical Reference on Green Power, available at http://energystar.gov/greenpower.

Does renewable energy count towards a building's total energy usage?

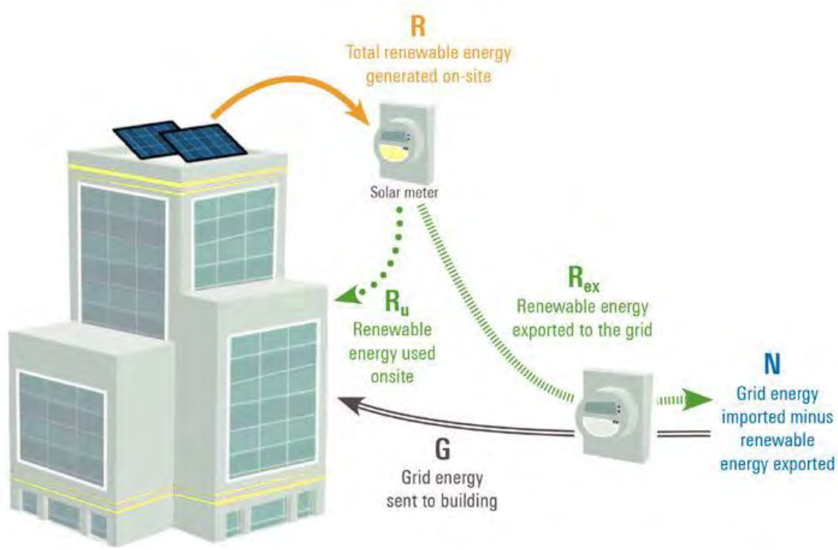
Yes, the partner will receive credit for generating on-site renewable electricity. All energy use is tracked in terms of source energy, and the conversions from site to source energy are lower for on-site renewable electricity than they are for grid-purchased electricity.

What data is needed from the on-site renewable energy system?

Four specific data points are needed when benchmarking an on-site renewable energy system. These are listed below and described in more detail in the Portfolio Manager Technical Reference on Green Power, available at http://energystar.gov/greenpower.

- Renewable energy exported to the grid (R_{ex}),
- Renewable energy used on-site (R_u),
- Grid energy sent to building (G)
- The ownership status of the systems renewable energy certificates (RECs).

The total energy to the building is represented by R_u + G, where R_u is the portion of the energy that is renewable.



What energy use data is provided by the utility for renewable energy systems?

This can vary by location, and even within a single utility service territory, but the most common approaches are included below:

- Bi-directional flows (R_{ex} and G from the diagram): In this case, the utility provides both the energy exported to the utility from the renewable system, as well as the amount of energy that the utility sends to the customer. This information may be on the utility bills, or it can be requested from the utility, but it is not always available.
- Net metered amount (N = G minus R_{ex} from the diagram): In this case, the utility provides the difference between what the utility provides to the customer and the amount of energy exported from the renewable energy system. This can often be insufficient information to understand the property energy use, unless the property is separately metering the energy exported to the grid.

Utility bills will not include renewable energy system production numbers ($R = R_u + R_{ex}$ from the diagram). For those values, dedicated meters or monitoring services are required.

What sources of energy use data are available for renewable energy systems?

Utility bills and/or bills from a renewable energy service provider may contain the necessary data points to track energy use from on-site renewable energy systems. If some or all of the data is missing, the following steps are recommended to gather renewable energy data:

1. Consult with the solar installer/owner that has been monitoring system production. Depending on the contractual structure, they might have a separate monitoring system in place.
2. Contact the electric utility to determine if other/additional data reporting options are available.
3. Install one or more meters for the renewable energy system. It is possible to directly meter the renewable energy used by the building (R_u from the diagram). Alternatively, it is common to measure the full renewable energy production ($R = R_u+R_{ex}$ from the diagram), which can be combined with bidirectional flow values from the utility to isolate the renewable energy used by the building (R_u from the diagram).

What if historical energy use data for a renewable energy system is not available?

While the Better Buildings Challenge requires actual energy use to be reported for all properties, an exception can be made in the case of renewable energy systems. If a production meter on the renewable energy system is installed that provides current energy use but historical data was not metered, partners are permitted to estimate renewable energy data for previous years using a full year’s data generated by a production meter.

What if complete information on renewable energy use cannot be obtained for a property?

If the necessary information is not available, the property will be excluded from a partner’s Better Buildings Challenge portfolio-level energy savings calculations until this data becomes available. Contact your Better Buildings Challenge account manager to ensure that all potential solutions for tracking energy for the property have been explored. (If the on-site renewable energy use accounts for less than 5% of the total energy use of the building, and is therefore not required to be reported, the property will still be included in portfolio-level energy savings calculations.)

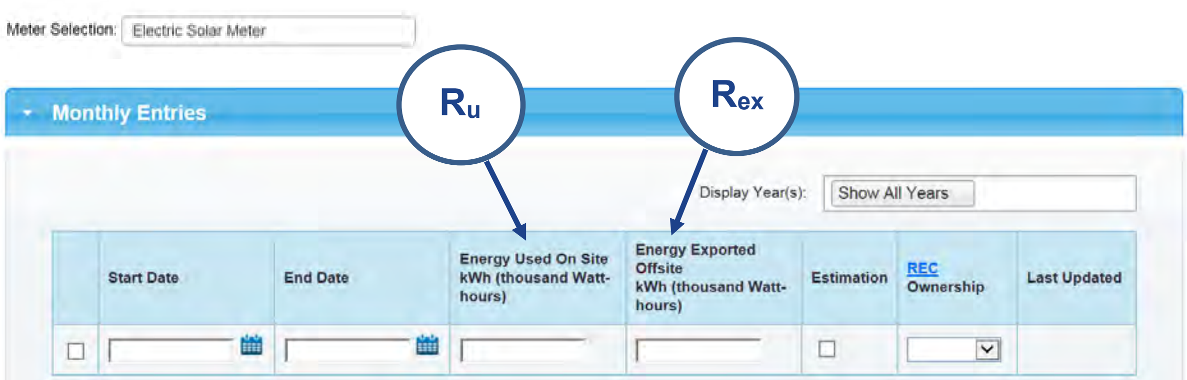
How should energy data for renewable energy systems be entered into Portfolio Manager?

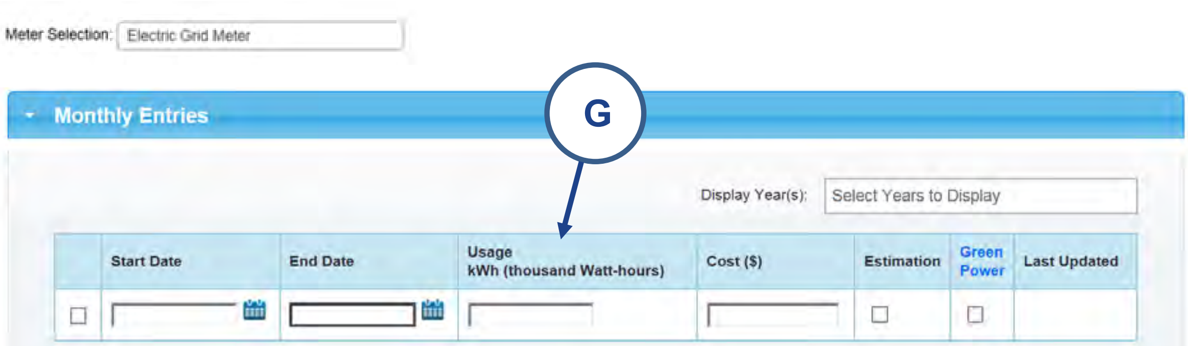
To enter data in Portfolio Manager, enter one meter for on-site renewable energy data and one meter for grid-purchased electricity. For detailed instructions on how to enter renewable energy data, see the Portfolio Manager FAQ on entering onsite green power, which can be found at http://energystar.gov/buildingshelp.

The table below provides a worksheet to help determine how to enter the data for a property. Identify the data needed in the first column, and use the second column to add notes on where to find this information for the property (e.g., the bill from a solar service provider, a utility bill, in-house meter readings, etc.). The third column can be used to enter values for a particular billing period, for reference.

The screen shots below show where to enter this information in Portfolio Manager.

DESCRIPTION OF METERS TO ENTER (from Portfolio Manager Guidance)	WHERE TO FIND THIS INFORMATION	EXAMPLE
On-site Solar Meter ($R = R_u+R_{ex}$)		
R_u = Generated by System and Used at Building		
R_{ex} = Generated by System and Exported to Grid		
Grid Purchase Meter (G)		
$N = G - R_{ex}$ = Net meter reported by utility		
R_{ex} = Export Value		
Total Energy to Building (R_u+G)		

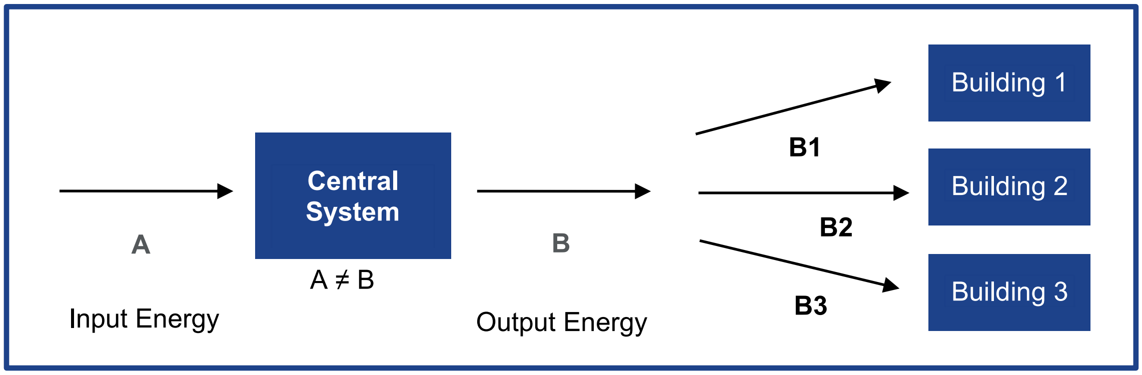




Appendix G – Central Systems Guidance

Commercial building partners with multi-building properties often operate central systems to deliver energy to buildings. These may include central heating or chiller plants, on-site electricity generation, or combined heat and power (CHP) generation.[11] Each of these systems has output energy (e.g., electricity, heat, chilled water) that is delivered to the buildings, and also has input energy (e.g., natural gas, oil, biomass, etc.) to the system. A schematic diagram of a central system is shown in **Figure G-1** below. The output energy (B) will be different than the input energy to the system (A). It will be lower for heating systems and electricity generation, due to combustion inefficiencies and other losses, and higher for chillers, which use the input energy to transfer heat.

FIGURE G-1: SCHEMATIC DIAGRAM OF A CENTRAL SYSTEM



It is important to correctly account for energy use associated with central systems. Three different options to properly track energy use for central systems are described in **Figure G-2** on the following page. For each option, the table explains how data should be reported, when each approach should be used, and the implications of each approach. If the partner exports energy from a partner-managed central system to properties that are not managed by the partner, the table includes guidance for reporting exported energy for each option.

Despite the differences between the options, ***all three options produce similar results in terms of EUI***, as described further on the following pages. Because the three options produce generally the same results, they are all considered acceptable by DOE. The best approach for a particular partner will depend upon whether the system is metered by building, and whether a partner has the data, ability, and resources necessary to perform the required calculations.

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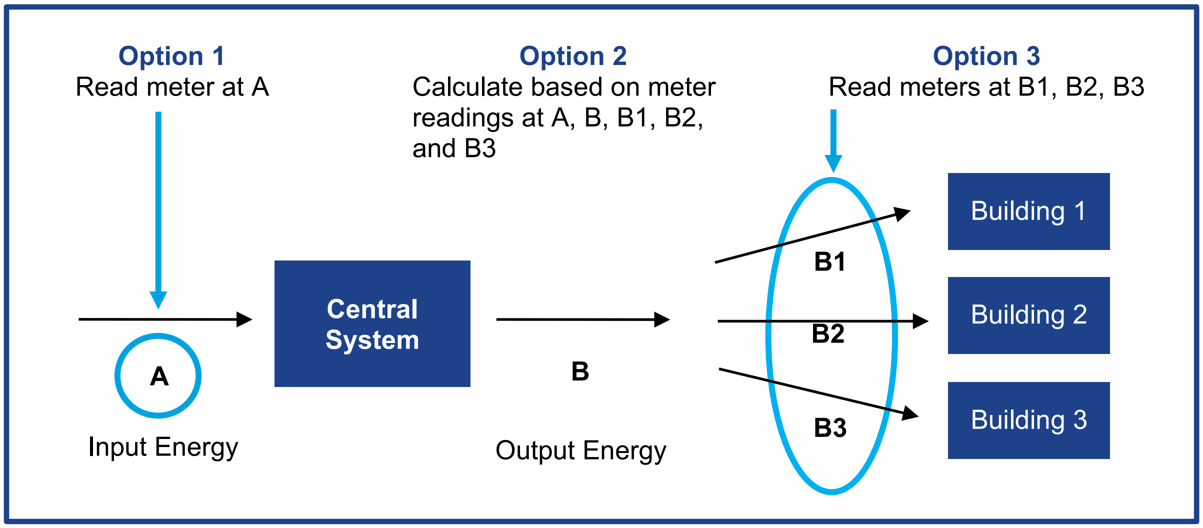
[11] CHP, also known as cogeneration, is the production of electricity and a form of useful thermal energy (such as heat or steam) used for industrial, commercial, heating, or cooling purposes. Definition of cogeneration from Department of Energy, Energy Information Administration. http://www.eia.doe.gov/glossary/

FIGURE G-2: OPTIONS FOR TRACKING ENERGY DATA FOR CENTRAL SYSTEMS

	Option 1 Report Input Energy	Option 2 Report Input Energy By Building	Option 3 Report Output Energy By Building
How is data reported?	Report input fuel to the system (natural gas, oil, biomass, etc.). All of the output energy generated (electricity, heat, chilled water) is accounted for by the fuel going into the system. Standard source-site factors for the input fuel will be applied.	All output energy (electricity, heat, chilled water) produced and delivered by the system is metered by building. The total system output energy used by each building is determined, as well as the percent of the total system output that the building represents. This percentage is used to apportion the input fuel use to each building, and the ***input fuel use is reported***. Standard source-site factors for the input fuel will be applied.	Report the output energy from the system (electricity, heat, chilled water). Standard source-site factors for the output fuel will generally be applied. However, if a system operator wants to obtain credit for the efficiencies of a CHP system, an alternative to the default source-site conversion factors can be applied to the output energy, provided calculations are documented, based on sound engineering principles and the electric and thermal efficiency of the system, and are used consistently over time. A detailed description of methodology will need to be reviewed and approved by DOE.
When should this approach be used?	For central systems ***without*** individual metering of the output to buildings. This is also the required approach for heating/cooling plants, on-site generation, or CHP systems for single buildings.	For central systems ***with*** individual metering of the output to buildings. This approach may be simplest for systems that serve a small number of buildings, since calculations can be time consuming.	For central systems ***with*** individual metering of the output to buildings. This approach may be most appropriate for larger systems that are similar to power plants operated by a utility. Operators of these systems may be more likely to have the ability to calculate source-site conversion factors for the system. This approach is also the most appropriate for systems that are exporting a portion of their energy to buildings that are not part of the program.
What are the implications of this approach?	This approach provides the system operator with credit for efficiencies associated with the system. It is not possible to track building-level energy consumption data, which partners are encouraged to provide for the Better Buildings Challenge.	This approach allows building-level energy performance tracking, and allows operators to associate central system efficiencies with all buildings served by a system.	This approach allows building-level energy performance tracking, with fewer calculations by the operator. Note: Alternative source-site conversion factors cannot be used if a partner is reporting energy use in Portfolio Manager, because this tool only uses standard source-site factors, but can be used if the partner is using the Better Buildings Challenge Data Collection Template.
How should exported energy be handled?	Determine the percent of exported energy to the total energy generated by the system, and subtract that same percent from the amount of input fuel.	Follow the same procedure to pro-rate energy use by building, and subtract energy use from any buildings not managed by the partner.	Since output energy is metered at the building level, exported energy can be ignored.

Figure G-3 below illustrates the data needed for energy use calculations, as well as sample energy use calculations. The calculations were generated for an on-site generation system with 100 units of input natural gas and 34 units of output electricity. Of the 38 units of output energy, 40% goes to Building 1, 25% to Building 2, and 35% to Building 3. As described previously, all three options to track energy use produce generally the same results. Options 1 and 2 both track input energy. The only difference between them is that Option 2 provides results by building. Option 3 tracks output energy, which produces different results for site energy. But once the source-site conversion factors are applied (conversion factors are based on those used in Portfolio Manager, available at http://www.energystar.gov/sourceenergy, the source energy for the entire system is similar to Option 1 and 2. Slight differences in source energy values can occur depending on the efficiency of the system compared to average system efficiencies assumed in the standard source-site conversion factors.

FIGURE G-3: ENERGY USE CALCULATIONS FOR CENTRAL SYSTEMS



	Option 1 Report Input Energy	Option 2 Report Input Energy By Building	Option 3 Report Output Energy By Building
Formula to Compute Site Energy	A	B1/B x A + B2/B x A + B3/B x A	B1 + B2 + B3
Site Energy Use by Building	n/a	Building 1 = B1/B x A = 40 Building 2 = B2/B x A = 25 Building 3 = B3/B x A = 35	Building 1 = B1 = 15.2 Building 2 = B2 = 9.5 Building 3 = B3 = 13.3
Total Site Energy Use	**100**	**100**	**38**
Fuel Type	Natural Gas	Natural Gas	Electricity
Site-Source Conversion Factor	1.05	1.05	2.80
Source Energy Use by Building	n/a	Building 1 = 40 x 1.05 = 42.0 Building 2 = 25 x 1.05 = 26.25 Building 3 = 35 x 1.05 = 36.75	Building 1 = 15.2 x 2.80 = 42.56 Building 2 = 9.5 x 2.80 = 26.6 Building 3 = 13.3 x 2.80 = 37.24
Source Energy Use	**105**	**105**	**106.4**

Appendix H – Water Data Tracking

The commercial building and industrial sectors account for more than 25% of withdrawals from public water supplies and many organizations in these sectors may have savings opportunities of 20 to 40%. The efficient use of water resources results in lower operating costs, a more reliable water supply, and improved water quality. Additionally, because energy is required to transport and treat water, saving water also saves energy. Qualifying partners may choose to track and report water data as part of their Better Buildings Challenge commitment.

Partners sharing water data will establish a goal across their portfolio and share baseline data within 6 months and performance data on an annual basis thereafter. Partners also commit to develop a showcase project and an implementation model highlighting water savings accomplishments. DOE will work with partners to identify and overcome the barriers to saving water and tracking progress and to document best practices.

Portfolio Commitment and Goal

Partners should commit their entire portfolio of properties in their water savings goal. Generally, the portfolio of properties covered under a partner’s water goal should match what is covered under their energy goal. Partners should discuss any discrepancies with their Better Buildings Account Manager. Data for all water sources should be provided. This includes municipally supplied potable water, municipally supplied reclaimed water, and freshwater sources (onsite well water, lakes, and streams). Many organizations utilize water that has been recycled on-site. While it is considered a best practice to separately meter recycled water, partners should not report recycled water use to DOE, since the savings associated with this practice are reflected in reduced water consumption from other sources. Partners are encouraged to provide data for all indoor and outdoor uses. Partners may choose to limit their goal and reported data to include indoor use only, but may not participate with outdoor use only.

Partners are encouraged to set a water savings goal of at least 20% improvement over 10 years, relative to a baseline year, similar to their energy goal. Goals should be based on water use intensity. Water savings progress will be tracked against a baseline year. Partners are encouraged to select one of the three most recent calendar years prior to committing to a water goal as the baseline year. If a partner prefers to use the same baseline year for their water goal that is used for their energy goal, it is acceptable to select a baseline year prior to the three most recent calendar years. Partners should contact their Better Buildings Account Manager to discuss the specifics of baseline selection and water savings goals.

Water Data Tracking

For typical properties, water use intensity will be measured in terms of water use per square foot (gal/ft^2). The normalization metric of square feet is the same metric used for tracking energy data. Partners who are utilizing other metrics to track water use intensity should discuss options with their Better Buildings Account Manager. The use of Portfolio Manager for water use tracking is strongly encouraged. Portfolio Manager allows partners to track both energy and water consumption within the same tool, and easily share data with DOE. Partners who are not currently using Portfolio Manager may submit water data using the Better Buildings Challenge Data Collection Template, available on request.

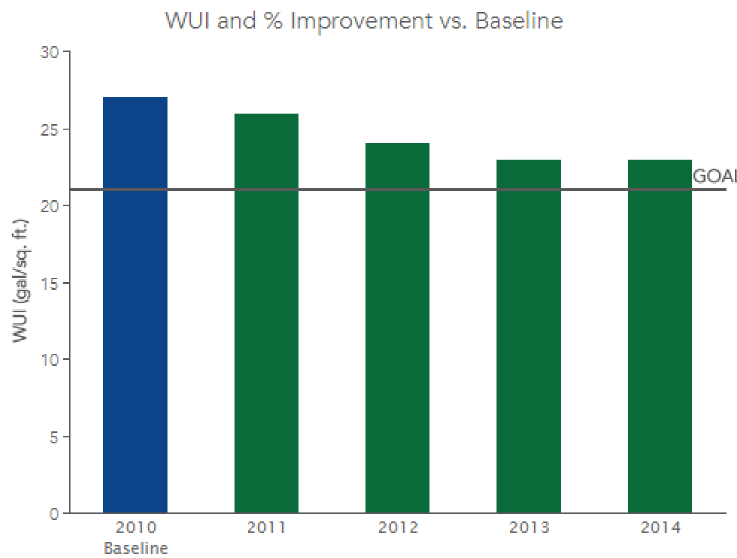
Water Performance Results

Better Buildings Challenge partners providing complete data to track progress towards goals will be recognized for their achievements. Water savings recognition will depend upon partners demonstrating progress toward reaching their stated goal. Partner progress towards achieving water savings goals will be displayed at the bottom of their Performance Results web page on the Better Buildings Solution Center. An example water performance chart is shown in **Figure H-1** below.

FIGURE H-1: SAMPLE WATER PERFORMANCE RESULTS

WATER PERFORMANCE: SUMMARY

Better Buildings Challenge Partners strive to decrease portfolio-wide water use intensity (WUI) and to increase the percent improvement compared to a set baseline. The Tower Companies tracks water data for nearly 3 million square feet as part of this program. The building teams have improved water performance by 15% from a 2010 baseline, making progress toward a goal of 20% by 2020. These reductions were realized in part thanks to an indirect consequence of their energy management program. In addition, the company works with the landscaping vendors to ensure native plantings that require less irrigation, green cleaning vendors to reduce water used when possible, construction purchasing practices that require low-flow fixtures be installed, and cooling tower management practices that ensure efficient operations.



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