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

And

The Joint Legislative Energy Policy Commission,

Joint Legislative Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division

Pursuant to GS 143-64.12(j)

December 1, 2023

Prepared by:

North Carolina Department of Environmental Quality

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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 requires all state-owned buildings to reduce energy usage intensity (EUI)[1] by 30% based on 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% EUI reduction goal. This report also includes recommendations for further actions that may be necessary to meet the EO80 goal for state-owned buildings.

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 FY2022-23, all state-owned buildings attained an overall 33% reduction in EUI from the 2002-03 baseline. Without additional monetary investments to implement energy conservation measures, we are not on track to achieve the EO80 goal. 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.

[1] Represents energy consumption per gross square foot (Btu/gsf)
[2] Excludes leased buildings whose utility bills are not paid by state governmental entities.

Table 1: State Government Buildings Energy Efficiency Gains (FY03-FY23)

Participant		Cabinet Agencies	Other Agencies[1]	UNC System[2]	State Governmental Units Total
Gross Square Footage	**% Change**	+29%	-1%	+64%	+50%
Energy Usage Intensity (Btu/square foot)	**% Change**	-31%	-21%	-36%	-33%

[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, 67% of the total gross square footage, and 71% of all utility spending. Fortunately, they have also proven to be the pinnacle of energy management considering that the UNC System currently shows a 36% reduction in EUI from the 2002-03 baseline. This accomplishment occurred despite increasing square footage by 64% 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 $150 million for the UNC System alone in FY2022-23. In addition, cumulatively, the UNC System has avoided $1.6 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 77% of avoided utility costs for FY2022-23 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. The UNC System Office, UNC Charlotte, UNC Wilmington, Western Carolina University, and Appalachian State University all achieved EUI reductions of 40% or more this fiscal year (FY2022-23) compared to baseline (FY2002-03).

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, 33% of total state-owned square footage, and 29% of total state-owned utility spending. Since FY2002-03, agencies have avoided approximately $45 million in utility costs while their gross square footage has increased by 28%. 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 21% 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 30 million gross square feet and $50 million in annual utility spending. Since their unique 2007-08 baseline, community colleges have achieved a 16% EUI reduction despite a 35% increase in square footage. In addition, they have cumulatively avoided over $62 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.

Cost Savings and Air Pollution Benefits Related to Energy Conservation

While most energy efficiency projects require upfront initial investments, they are accompanied by energy 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 $350 million on utilities which equates to approximately $956,164 per day. Of course, this would have been $198 million higher in FY2022-23 without the avoided costs from energy efficient building upgrades. As the data shows, the Comprehensive Program has achieved $1.96 billion in savings for North Carolina's taxpayers since the FY2002-03 baseline. Further investments in building efficiency improvements toward the EO80 goal can result in additional millions of dollars in utility savings for all state-owned buildings. Actual savings may be higher due to rising fuel and electricity costs.

Table 2: State Government Buildings Energy Costs and Savings (FY03-FY23)

Participant	Cabinet Agencies	Other Agencies	UNC System	State Governmental Units Total
Actual Utility Costs (FY23)	$101 million	$1 million	$247 million	$349 million
Avoided Utility Costs (FY23)	-$44 million	-$1 million	-$153 million	-$198 million
Cumulative Avoided Utility Costs (FY03-FY23)	-$352 million	-$12 million	-$1.6 billion	-$1.96 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. FY2022-23 estimates show that the program avoided 1,041,351 metric tons of carbon dioxide equivalent ($MTCO_{2e}$)[3] in greenhouse gas (GHG) emissions for state governmental units.

[3] *$MTCO_{2e}$ 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 ($MTCO_{2e}$)."*

Cumulatively since FY2002-03, approximately 10.1 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 1,272,940 homes annually, or 2.7 coal-fired power plants in one year.[4]

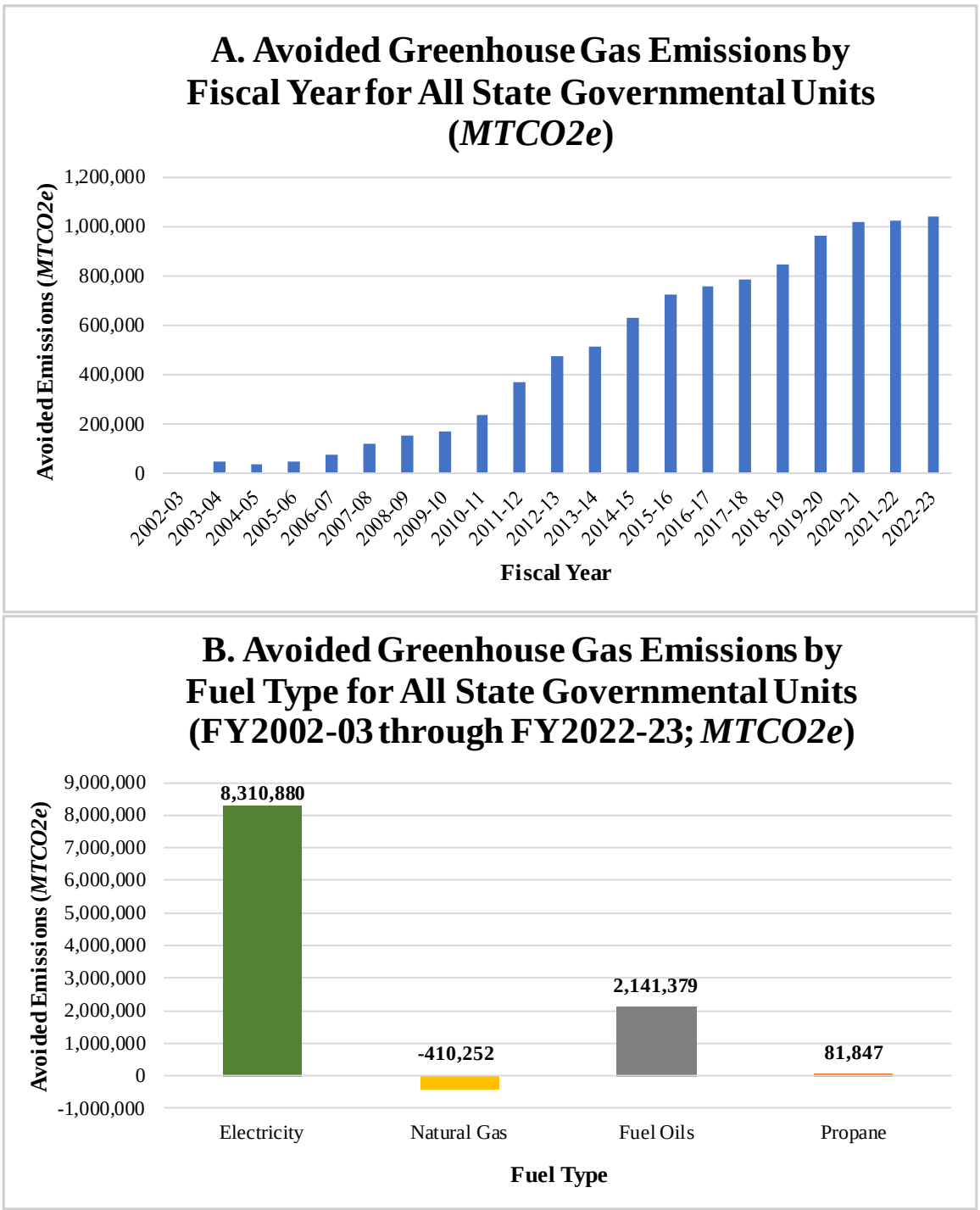


Figure 1: Avoided Greenhouse Gas Emissions for All State Governmental Units *($MTCO_{2e}$)* by (A) year and (B) fuel type.

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

Cabinet Agency Energy Projections to 2025

Although the EO80 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 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 worked with energy managers across the largest five cabinet agencies (i.e., DAC/DPS, DHHS, DOT, DOA, DNCR) to target 104 buildings and nearly 200 energy efficiency projects 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]. When compared to the EO80 project pipeline from FY21-22, project costs have increased by roughly 33% largely due to inflation, while energy and monetary savings have decreased substantially, resulting in projects that are generally less financially attractive and more complex.

Table 3 illustrates that the cabinet agencies are collectively projected to achieve a -34% EUI by 2025 through $47 million in anticipated performance contracts and $158 million in unfunded projects. This combined with the exemplary reductions from the UNC System would assist with meeting the EO80 goal by 2025, however would still likely fall short of the -40% EUI goal. The challenge is that cabinet agencies will 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. The main challenge remains the short timeframe left to reach the -40% EUI goal, as well as the pipeline of projects which have become more expensive due to inflation, with less energy savings due to higher complexity.

Table 3: Cabinet Agency Results from EO80 Projections

Cabinet Agency	FY2022-23 EUI Reduction	Estimated Reduction through FY2025 with Energy Projects	Performance Contract	Unfunded Project Amounts
DAC	-22%	-24%	$36MM	$32MM
DHHS	-37%	-42%	-	$41MM
DOT	-30%	-48%	-	$56MM
DOA	-36%	-39%	-	$10MM
DNCR	-38%	-11%	$11MM	$15MM
DIT*	-1%	-6%	-	$1MM
DOC**	-16%	-16%	-	-
DEQ*	-36%	-44%	-	$1MM
TOTALS	**-29%**	**-34%**	**$47MM**	**$158MM**

* 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 suggest energy efficiency improvements. Some of these improvements are well-defined such as increasing building envelope insulation or converting to LED lighting, while other measures such as building controls and HVAC improvements are more abstract and can be 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 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 addition, shifting the focus towards broad energy management concepts will help ensure energy efficiency becomes a cultural change with long-term commitments and results. This includes concepts such as the following:

- Offsetting competing energy priorities *(i.e., electric vehicle charging infrastructure vs. energy efficiency improvements)* with clean energy sources
- Designating full-time energy managers
- Investing in more sophisticated data collection, reporting, and analysis systems
- Considering alternative strategies for financing 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 (with exceptions incorporated, as needed)
- 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 and funding opportunities, and continuously promotes and implements both large and small energy efficiency measures. These same initiatives and strategies should be utilized by all governmental sectors wherever and whenever possible.

In summary, the EO80 goal can only be achieved with immediate investment and implementation of substantial energy efficiency improvements within the next fiscal year (i.e., FY2023-24). State governmental units should make the necessary changes to prioritize energy efficiency, enlist the support of leadership and designate energy managers, and explore any and all pathways to funding these critical improvements. The remainder of this report's narrative provides the following: significant changes from FY21-22's report; 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) suggested revisions to general law.

2.0 Significant Changes from FY21-22 Report

During and after FY2021-22, several reporting entities implemented hybrid telework arrangements and health and safety measures to combat COVID-19. In theory, these arrangements could reduce energy use requirements; however, as the governmental entities rapidly transitioned to a modern work environment, the health and safety measures utilized to combat COVID-19 generally increased energy usage in occupied buildings. For FY2022-23, many of the hybrid work environments continued, and state governmental units expect it to remain for years to come. Nevertheless, after conversations with governmental entities we noted that most of these entities are back to normal pre-COVID 19 operations with few exceptions.

The Department of Public Safety (DPS) and The Department of Adult Corrections (DAC) split into separate entities this year. The Session Law 2021-180 established DAC as a new cabinet-level agency apart from DPS. The separation of DAC from DPS was accomplished over a year, with a final effective date of January 1, 2023. This split means that the reporting received from these two agencies should be separate, however this year's numbers for both DAC and DPS still rolled up into DPS. The goal for next year's report is to have separate line items for DPS and DAC; this will likely impact the overall EUI numbers reported for each agency given the dramatic change in square footage and lack of historical/baseline data particularly for DAC as a new, standalone agency.

The State Energy Office did not receive FY2022-23 energy usage information from the Department of Transportation (DOT). Due to the lack of data, the SEO duplicated DOT's data from their FY2021-22 usage to provide consistency in DOT's weight among agencies in the state. More information on this can be found in Appendix A of this report.

Staff turnover has been a part of each governmental entity and the USI program has had the same experiences for FY2022-23. North Carolina Department of Environmental Quality (DEQ) has a new State Energy Office Director and several new dedicated USI staff that have been equipped to provide technical assistance and guidance to whichever agency or entity that desires it.

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 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 2022-23, ten UNC System schools asked to carry forward over $17.2 million in savings and reported spending an additional $43.6 million for new energy efficiency projects.[5] 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.

[5] *The values in this report reflect the most accurate tabulation of the "savings claimed" and "cost of new projects" for FY2022-23 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 reduction 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 this 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 all State Governmental Units and Community Colleges

GS §143-64.12(j)(1): [The report shall contain:] *"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."*

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	1	56	91
	Current 2022-23 (Mgsf)	44	1	92	137
	% Change	+29%	-1%	+64%	+50%
EUI	Baseline 2002-03 (Btu/gsf)	128,615	75,305	170,329	153,665
	Current 2022-23 (Btu/gsf)	88,543	59,212	109,464	102,356
	% Change	-31%	-21%	-36%	-33%
Water	Baseline 2002-03 (gal/gsf)	63	15	49	54
	Current 2022-23 (gal/gsf)	45	6	23	30
	% Change	-29%	-58%	-54%	-45%

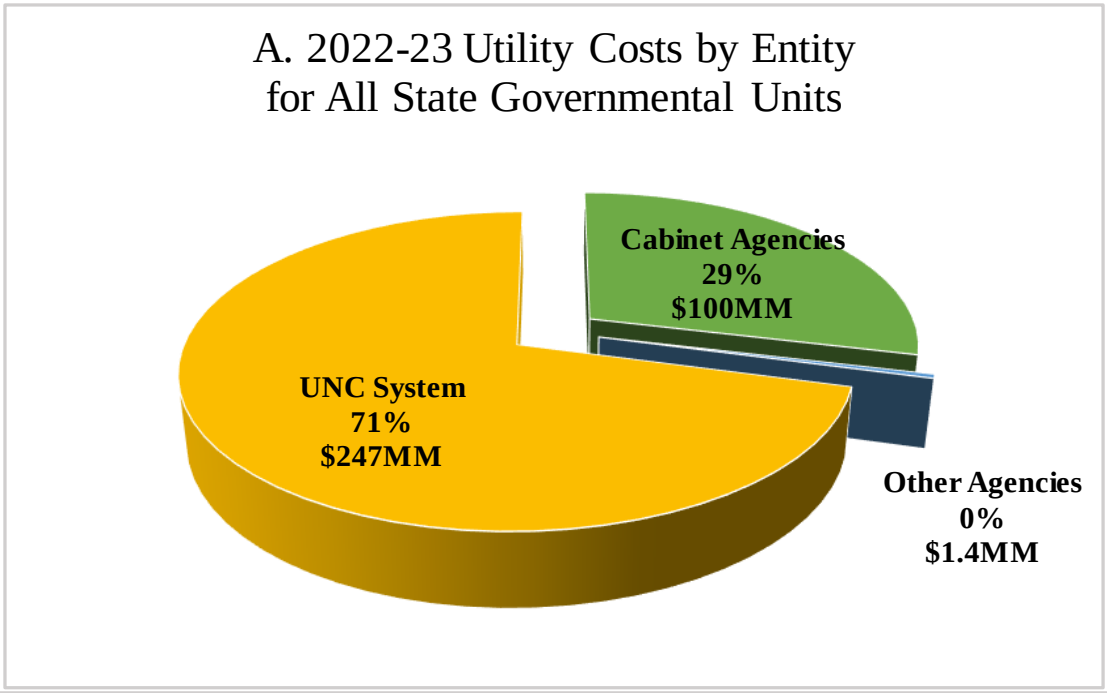
[1]The main WRC campus was not built until 2005-06, and thus, is not included in baseline (FY03)

[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 5

- EUI (Btu/gsf)
  - The Cabinet Agencies are at a 31% reduction from baseline
  - Other Agencies are at a 21% reduction
  - UNC System is at a 36% reduction
  - Total combined state-owned buildings are at a 33% reduction

- Change in Square Footage and Water Usage
  - Total combined state-owned building area has increased by 50% compared to baseline
  - Total combined water usage has decreased by 45% from the baseline



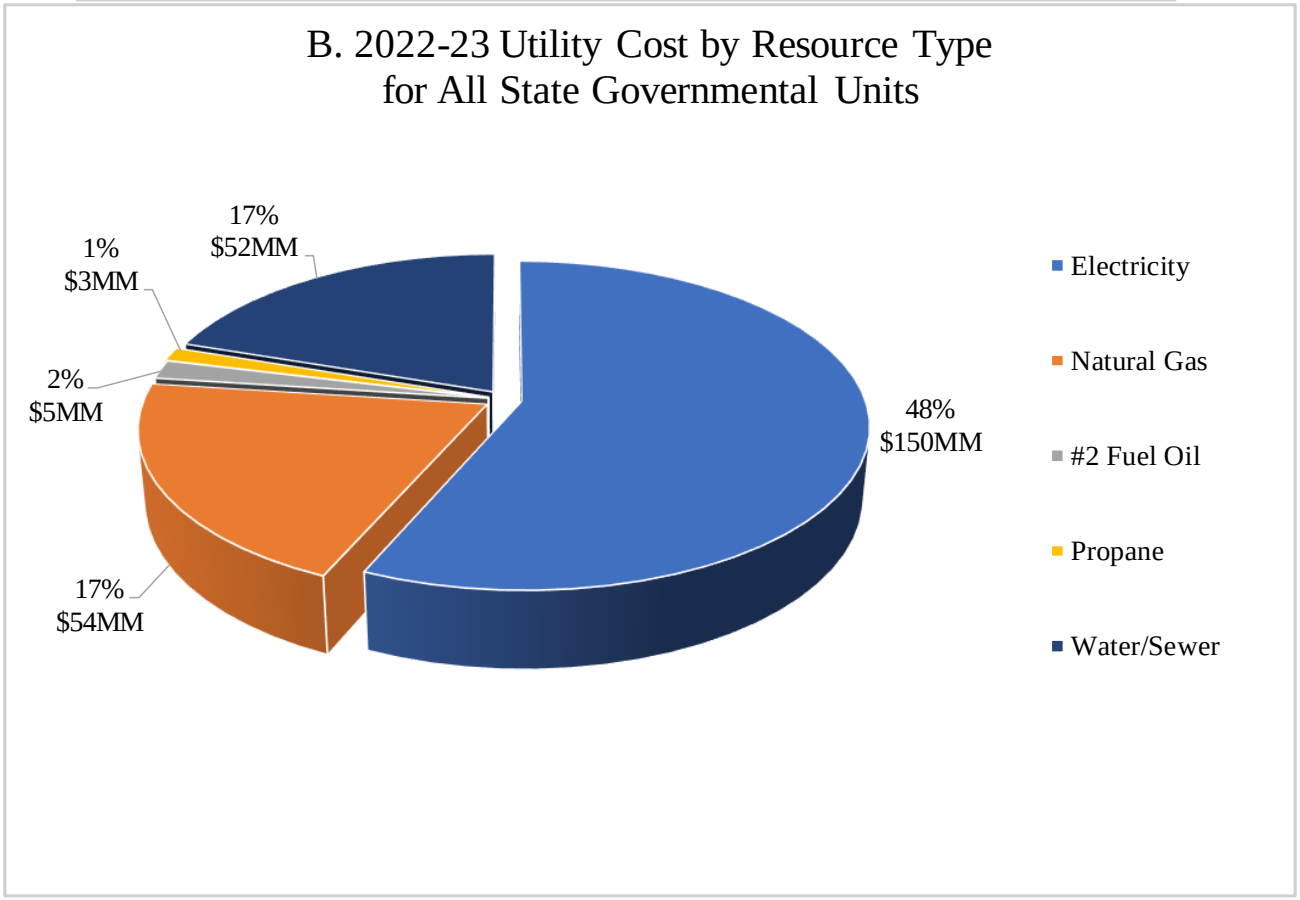


Figure 2: Total Utility Cost for All State Governmental Units ($349MM) by (A) Entity and (B) Resource Type.

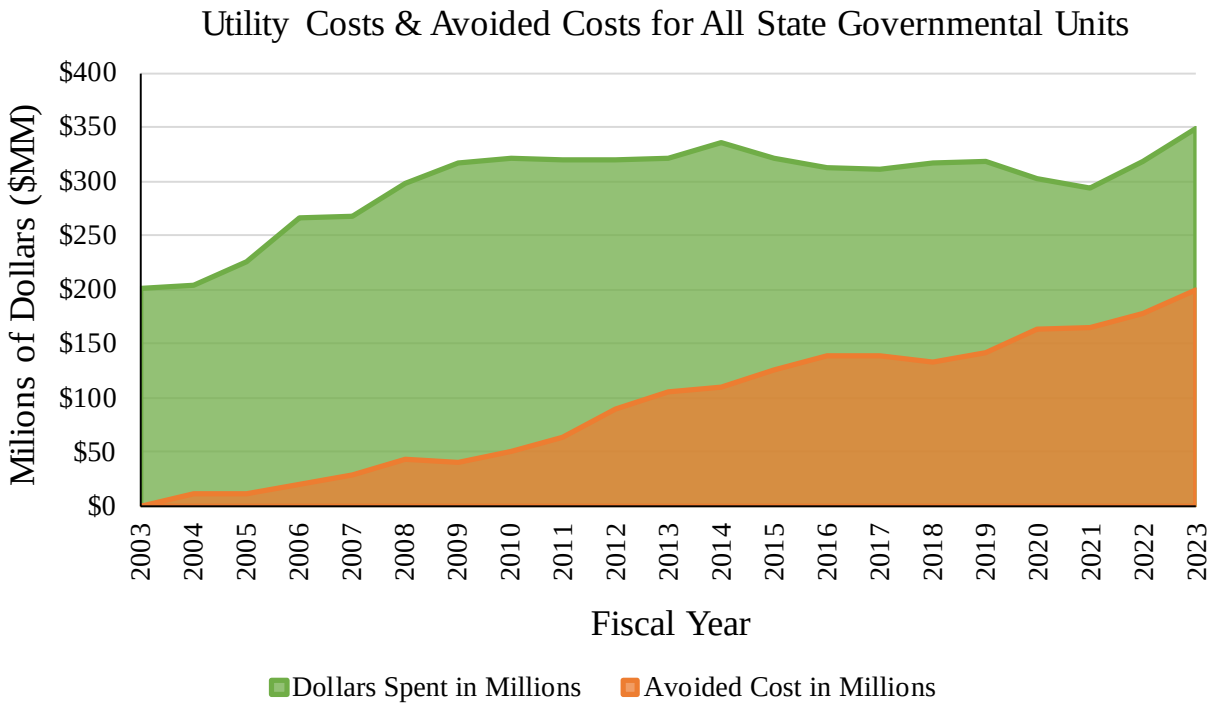


Figure 3: Avoided Utility Costs for All State Governmental Units

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

- Avoided Utility Costs
  - Approximately $198 million in avoided utility costs in FY2022-23.
  - Approximately $1.96 billion avoided in utility costs since FY2002-03.

- Expenditures
  - Approximately $349 million in total utility costs (electricity, fuels, and water) for FY2022-23 (this includes all agencies and the UNC System). Over two thirds of this amount is paid by the UNC System.

UNC System

In 2011, a discussion started at Appalachian State University to put together an Energy Summit for UNC System members to discuss EUI reduction efforts 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 Summit successfully reconvened for its 12th year in June of 2023, bringing together UNC System members for another fruitful and positive discussion on all things energy management. Through the Summit, the UNC System has emphasized that knowledge sharing is crucial for energy management success.

The UNC System and its affiliates continue to work hard to be at the forefront of 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, and more aggressive goals in some cases, was already being discussed and some of the UNC System were pushing towards this goal without EO80. This year's 2022-23 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 $1.6 billion in avoided costs between 2002-03 to 2022-23. The leading universities have energy management teams that consistently reinvest in efficiency projects; the UNC System Office and Western Carolina University led the UNC System's efforts in EUI reductions by achieving a 61% and 55% reduction from baseline, respectively. The USI team will continue to lean on these leaders of EUI reductions to better understand the source of their success and share this knowledge with others. The UNC System's overall EUI decreased by one percentage point this FY (i.e., moving from -35% in 2022 to -36% in 2023). The SEO will continue to look to the UNC System for guidance and leadership in energy management and energy reduction efforts.

Table 6 shows the UNC System summary. Square footage has increased by 64% while utility costs have increased by 85%. The UNC System had a 36% EUI reduction this fiscal year. Water usage has decreased by 54%, which is significant considering water costs have increased by 214% over the same timeframe. The SEO did not receive utility consumption data from Elizabeth City State University for FY2022-23.

Table 6: UNC System Utility Assessment

Metric	Fiscal Year		% Change
	2002-03[1]	2022-23	
Total Gross Square Feet	55,874,023	91,767,896	+64%
Total Utility Cost	$133,681,014	$247,377,941	+85%
Energy Usage (Btu/gsf)	170,329	109,464	-36%
Energy Cost ($/MMBtu)	$12.96	$22.20	+71%
Water Usage (gal/gsf)	49	23	-54%
Water Cost ($/kgal)	$3.75	$11.77	+214%

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

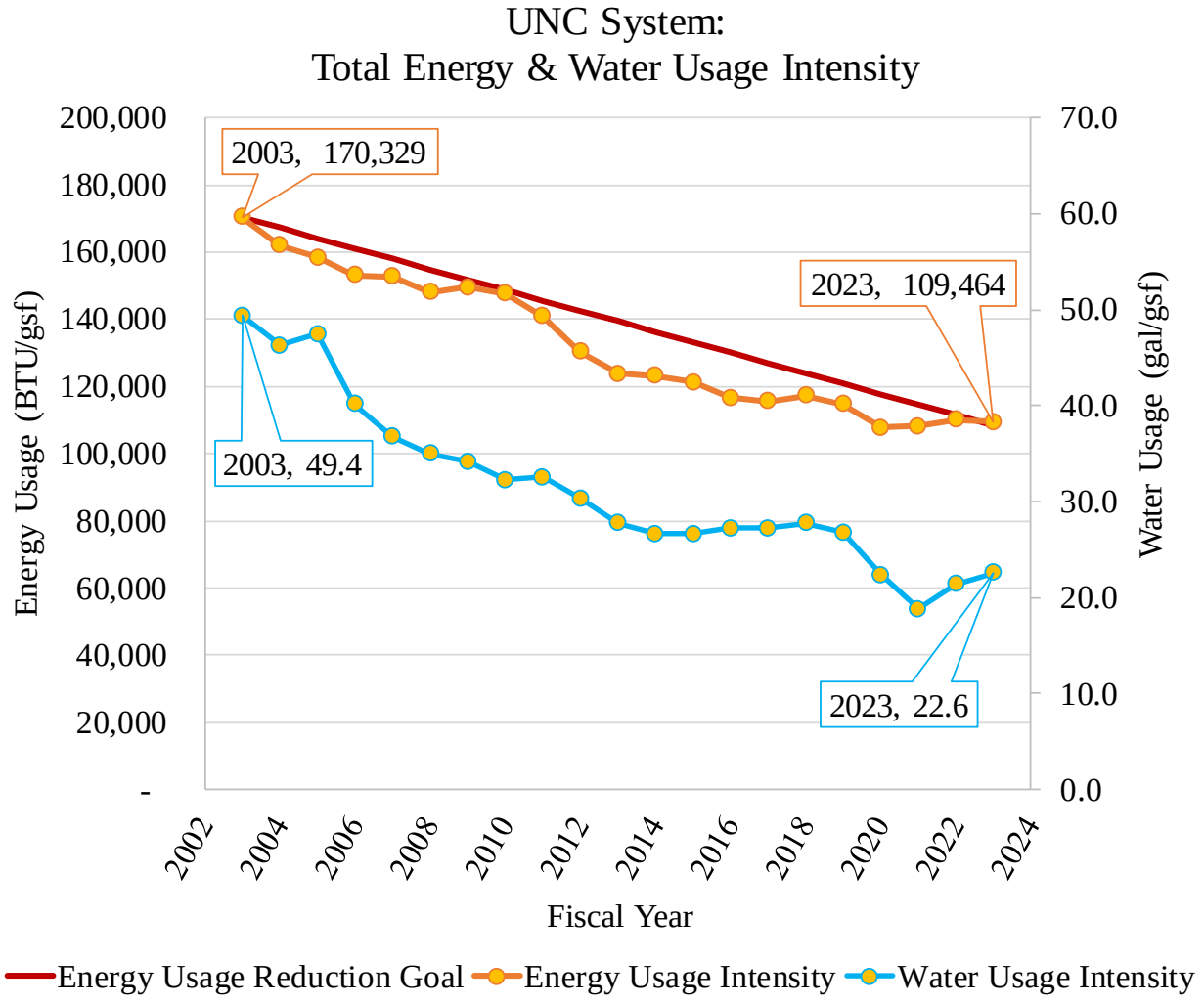


Figure 4: UNC System Utility Usage Over Time

Cabinet Agencies

As required by January 15, 2019, most cabinet agencies have appointed an energy manager to oversee the agency efforts in achieving the EO80 goal, with the exception of DPS since it split from DAC. DAC does have a designated energy manager, Paul Braese, who has done an exceptional job working with his team to prioritize energy efficiency in DAC's facilities. However most designated energy managers, with the exception of DAC, continue to have other full-time jobs and responsibilities beyond 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 is having a negative impact on energy reduction goals. This is emphasized by the utility spending of state cabinet agencies, which was approximately $101 million this year; more effective energy management and dedicated energy management roles would decrease 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 FY2022-23.

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, DAC and the Department of Natural and Cultural Resources (DNCR) are in the process of implementing GESCs for several of their facilities. The DAC project for six 1,000-cell prisons was recently approved at the September 12, 2023 Council of State meeting. The DNCR project includes the North Carolina Zoo, all three aquariums and five museums; their GESC is expected to be executed within FY23-24 pending Council of State approval. Both the DAC and DNCR GESCs combined are expected to save more than $70 million in energy savings over the life of the projects, a significant contributor toward the progress of EO80's goals.

Many agencies struggle with 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 if they are to reach the EO80 goal. Cabinet agencies are investing limited resources, as available, to move to LED lighting, provide staff the necessary resources and energy 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 29% while utility costs have increased by a staggering 50%. The EUI usage for all cabinet agencies has a 31% decrease since baseline. Water usage has decreased by 29% while water costs have increased by 136%. More detailed information about individual agencies can be found in Appendix A.

Table 7: Cabinet Agencies Utility Assessment

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	34,297,758	44,385,847	+29%
Total Utility Cost	$67,093,842	$100,575,616	+50%
Energy Usage (Btu/gsf)	128,615	88,543	-31%
Energy Cost ($/MMBtu)	$12.27	$18.39	+50%
Water Usage (gal/gsf)	63	45	-29%
Water Cost ($/kgal)	$5.98	$14.11	+136%

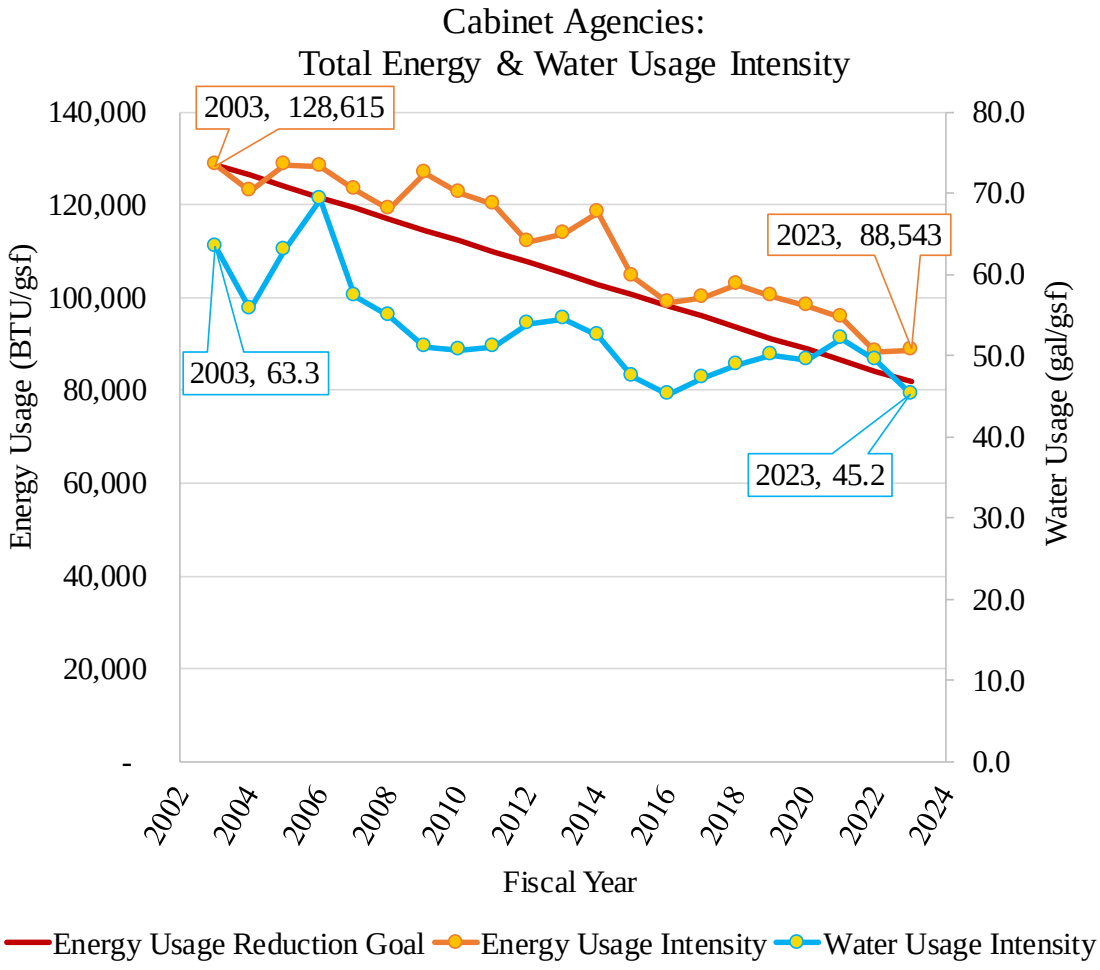


Figure 5: Cabinet Agencies Utility Usage Over Time

Other Agencies

While EO80 applies directly to the cabinet agencies, other state agencies are 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 Wildlife Resources Commission. 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 21% 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 essentially remained the same, while utility costs have increased by 35%. The EUI for all "other" agencies has decreased by 21%. Water usage has decreased by 58% while water costs have increased by 245%.

Table 8: Other Agencies Utility Assessment

Metric	Fiscal Year		% Change
	2002-03[1]	2022-23	
Total Gross Square Feet	917,553	906,266	-1%
Total Utility Cost	$1,017,407	$1,369,108	+35%
Energy Usage (Btu/gsf)	75,305	59,212	-21%
Energy Cost ($/MMBtu)	$13.45	$23.19	+72%
Water Usage (gal/gsf)	15	6	-58%
Water Cost ($/kgal)	$6.59	$22.77	+245%

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

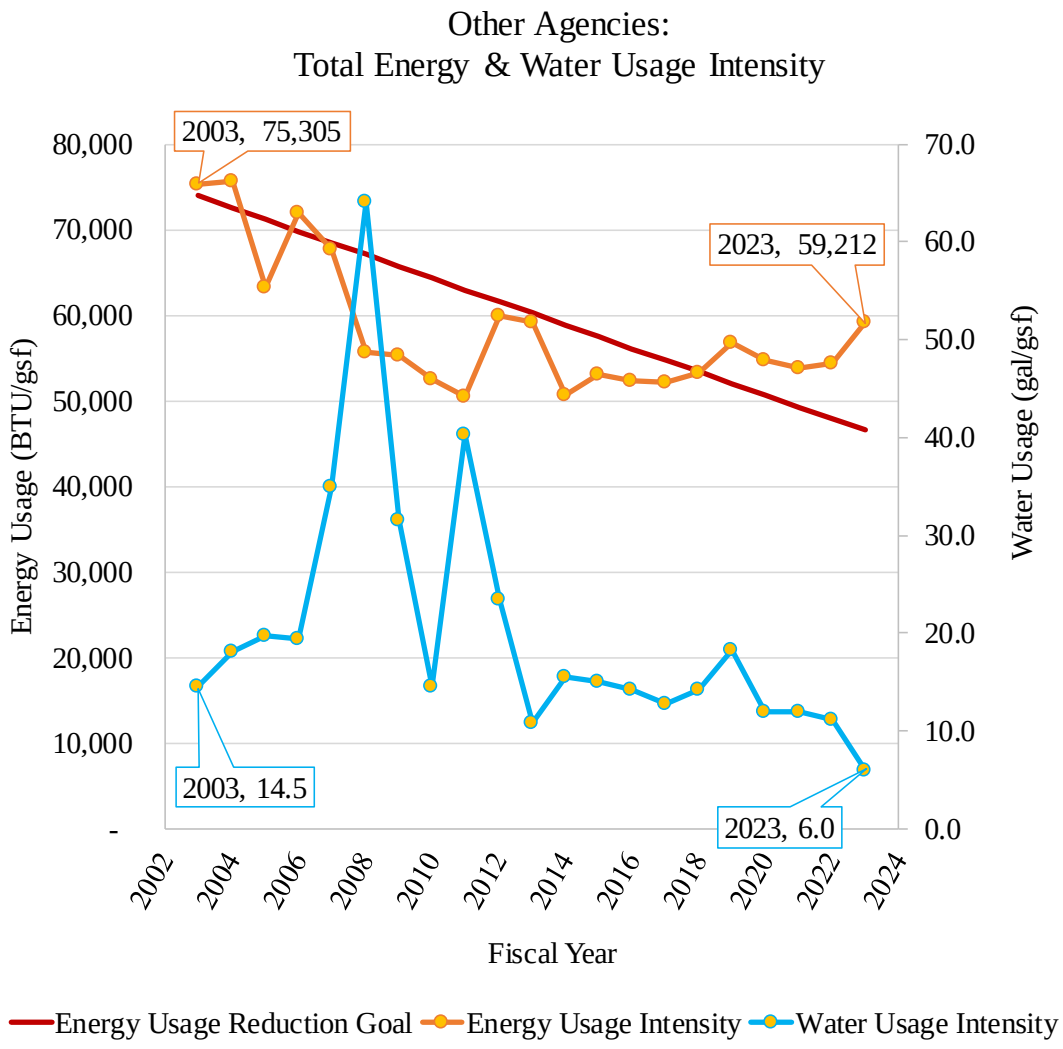


Figure 6: Other Agencies Utility Usage Over Time

Community Colleges

The North Carolina Community College System (NCCCS) is a key resource to provide accessible educational opportunities and to maximize student success. Since 2007-08, the NCCCS has been submitting annual utility consumption to the SEO. USI continues to meet several times a year with various community colleges to help identify energy efficiency projects and data collection issues. USI site visits are designed to assist with the development of utility management plans, to provide detailed understanding of the annual consumption reports, and to share best practices and successful EUI reduction strategies from other colleges. USI is often asked to guest lecture and to provide energy savings presentations to NCCCS faculty, staff, and students. There are two groups within the NCCCS that continue to address energy savings opportunities: the Association of Community College Business Officers (ACCBO) and the Association of Community College Facilities Operations (ACCFO). Both groups have annual meetings that USI attends and delivers an annual update. These annual meetings allow for open sharing of information, discussions on facility/financial issues and successes across the system. This allows the NCCCS schools to assist

each other in overcoming obstacles and with establishing networks for future collaboration. USI's attendance at these events continues to build relationships and often allows USI to meet new staff. During this past year, USI received annual utility consumption reports from all 58 community colleges.

Table 9 shows the community college summary. Square footage has increased by +35% while utility costs have also increased by +35%. The combined community college EUI is at -16%. Water usage has decreased by -1% while water costs have increased by +26%. As seen in Figure 7, water data for FY2022-23 spiked significantly; we will work with all community colleges in FY2023-24 to determine the source of this spike or whether this was a data error in reporting.

Table 9: Community Colleges Utility Assessment

Metric	Fiscal Year		% Change
	2007-08	2022-23	
Total Gross Square Feet	22,595,645	30,421,388	+35%
Total Utility Cost	$36,975,578	$50,029,886	+35%
Energy Usage (Btu/gsf)	79,411	66,920	-16%
Energy Cost ($/MMBtu)	$19.15	$22.43	+17%
Water Usage (gal/gsf)	15	15	-1%
Water Cost ($/kgal)	$7.88	$9.90	+26%

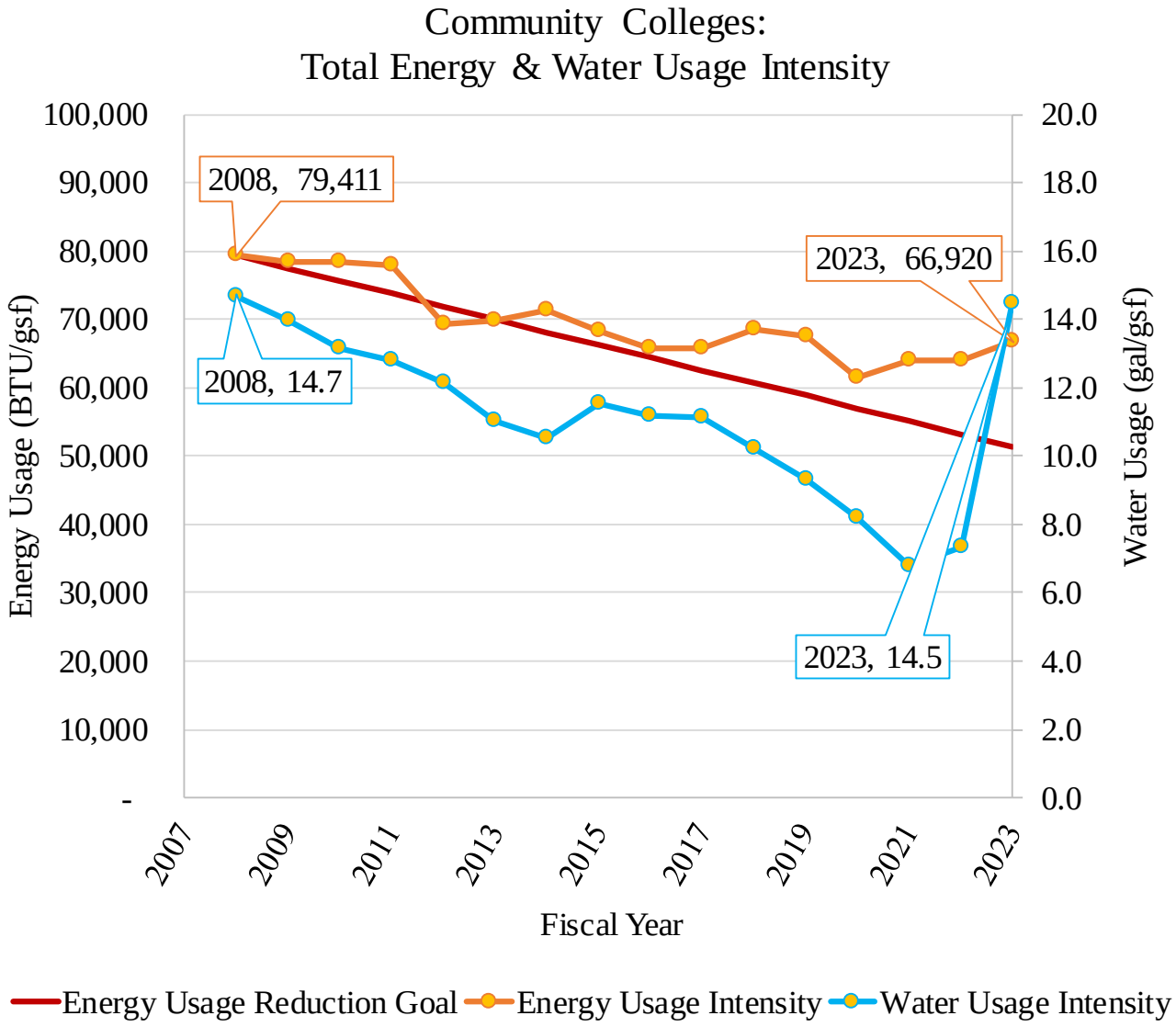


Figure 7: Community Colleges Utility Usage Over Time

4.3 Suggested Revisions to General Law

GS §143-64.12(j)(2): [The report shall contain:] *"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."*

Appendix F of this report contains more detail regarding these suggested revisions to general law. USI recommends annual reports from governmental agencies and universities on how the funds are spent in order to review for OSBM. The USI program has not previously required annual submissions of energy management plans; those reports are submitted biennially and are due in September to coincide with the utility usage reports. The carry forward program (Session Law 2010-196) instead reports project descriptions, including cost and energy savings and date of completion, in the form of an annual spreadsheet and project tracking log. USI recommends that it be due annually as well to review the quoted energy savings for validity.

Reporting Intervals

In the past, state governmental units were statutorily required to report annual energy, water, and other utility use to the USI program. This allowed USI's staff to efficiently locate abnormalities, provide best practices, and suggest measures to reduce energy consumption and costs. Unfortunately, Session Law 2014-120 changed this reporting requirement to a biennial-basis which created difficulties for USI's staff to obtain robust data to assist governmental units with energy management. The USI program supports reinstating the annual requirement for governmental units to provide a written report of energy, water, and other utility use in GS 143-64.12(a). In addition, under the same provision, the program supports clarifying that utility reports are to be submitted by state agencies, institutions of higher learning, and community colleges by September 1st of each year. GS 116-30.3B(c) states Constituent institutions shall submit biennial documentation reports on the use of funds since it was changed in 2023, which unfortunately conflicts with the directive in GS 143-64.12(a).

Energy Reduction Goals

State-owned buildings may achieve greater efficiency gains and cost savings if GS 143-64.12(a) were updated to incorporate the EO80, Section 8, goal of reducing EUI by 40% of FY2002-03 levels by 2025. As the analytical data in this report shows, the 2025 target year is achievable only by developing robust planning strategies, prioritized investments, and innovative mindsets to leverage existing resources that may further reduce energy consumption and costs. The USI program supports updating the energy reduction requirements since they would provide additional environmental benefits and reduced energy costs for future generations.

4.4 Summary of Utility Management Plans

GS §143-64.12(j)(3) – (j)(5): [The report shall contain:] *"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... 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...

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.[6] 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 provide a defined path and plan via a utility management plan. A strong utility management plan must contain clear strategies, objectives, and identification of funding sources for implementation. Additionally, plans should specify dates, responsibilities, and assignments for specific individuals/departments to ensure tasks achieve completion and energy efficiency is prioritized. Furthermore, these plans should include broad input from multiple divisions within a state governmental unit to ensure buy-in at a high level, as well as leadership endorsement and participation in order for the plan to be impactful. Acknowledgement and support of energy priorities must be communicated to the entire organization. By incorporating all of these critical elements, the plans have a higher likelihood of success in achieving the stated goals and objectives, bringing the organization closer to a strong foundation of, and commitment to, energy efficiency and energy management practices.

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 on the next page summarizes the governmental units that did and did not submit utility management plans for inclusion in this report for FY2022-23.

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

Table 10: Utility Management Plans Submitted FY2022-23

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)

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 submitted, 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 for the EO80 goal to be achieved. The mission of each governmental unit is critical, and there is a substantial amount of deferred maintenance, outdated equipment and 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[7] 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[8] 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,

[7] https://gebroadmap.lbl.gov/
[8] https://www.energy.gov/eere/solar/local-government-guide-solar-deployment

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.[9] 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.[10] 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.

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 -36% which exceeds cabinet agencies by -5% and other agencies by -15%. 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. DAC is the only state agency who currently has a full-time, dedicated energy manager. We hope that agencies follow this leadership and will be able to find funding mechanisms for these positions.

Once a full-time energy manager is hired, other factors must also be considered in order to help this position succeed. First, leadership can assist by prioritizing 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

[9] https://pv-magazine-usa.com/2022/08/11/michigan-pledges-to-cover-over-1200-public-buildings-with-solar/
[10] https://www.eia.gov/consumption/commercial/

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 could 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 there 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 principles 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 LEDs has decreased significantly since they were first introduced while the cost for non-LED lighting has increased as those technologies are being phased out. As such, LEDs not only reduce energy but are also now cost efficient. Moreover, studies continue to show that lighting style, such as cooler colors, can increase office productivity.[11] 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

[11] https://onlinemba.unc.edu/news/how-lighting-affects-productivity/

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 Department of Energy, this is accomplished to *"ensure that systems, and equipment in existing buildings meet the original design intent."*[12] 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 maintain a detailed and enforceable annual service/maintenance plan for all equipment.

4. Building Envelope Survey and Repairs

A building envelope survey should be done to assess and document the overall condition of the exterior of the 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 be diminished or negated.

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 should provide direction to employees and specify operational parameters of equipment that can be controlled to ensure stewardship of taxpayer funds and environmental resources. Benchmarking of facilities should also be incorporated into energy policy; benchmarking is a key piece of this report but should also be done on a more localized level within each individual entity to provide more data-driven energy management decisions.

5.2 Funding Methods

Federal Stimulus Funds

A. Inflation Reduction Act

The 117th United States Congress enacted the Inflation Reduction Act (IRA) on August 16th, 2022 under President Joe Biden. The IRA delegates $369 billion to programs and initiatives addressing climate resilience, energy efficiency improvements, and energy security programs. Elective Pay, also known as Direct Pay, provisions within the IRA make it possible for tax-exempt entities such as state agencies to receive the equivalent of a tax credit in the form of a cash payment for the installation of clean energy technologies such as installing electric vehicle infrastructure, battery storage, or renewable energy installations. The Production Tax Credit (§

[12] https://www.energy.gov/eere/femp/commissioning-federal-buildings

45) and the Investment Tax Credit (§ 48) provisions in particular provide significant incentives for production of, or investment in, renewable energy projects or sources. These elective pay provisions, in conjunction with the Energy Efficient Commercial Buildings Tax Deduction (§ 179D) providing tax deductions via building designers for new energy efficient commercial buildings or efficiency improvements to existing buildings, provide meaningful financial pathways to help governmental entities make the business case for both renewable energy investment and energy efficiency improvements.

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, in partnership with the North Carolina Clean Energy Fund, has applied for $250 million in funding from the Solar for All program within the GGRF; more information on the status of this application will be released in spring/summer 2024. This program would enable thousands of North Carolina households to access, for the first time in many cases, clean, resilient, and affordable solar energy through the design and launch of a low-income and disadvantaged community solar program. To maximize the benefits to North Carolina's low-income and disadvantaged communities, SEO plans to design programs that have the greatest impact with a focus on reducing greenhouse gas emissions, lessening energy burdens, and improving quality of life.

Section 60114 of the Inflation Reduction Act authorized the Climate Pollution Reduction Grants (CPRG) program under the EPA, providing $5 billion in grants to states, local governments, tribes, and territories to develop, strategize, and implement plans for reducing greenhouse gas emissions and other harmful sources of air pollution. North Carolina received a $3 million award this year for planning activities and intends to compete for the $4.6 billion implementation grants that EPA will start awarding next year. North Carolina is in the process of developing a Priority Climate Action Plan (PCAP) and a Comprehensive Climate Action Plan (CCAP). The PCAP, due March 1st, 2024, will identify North Carolina's highest priority greenhouse gas reduction measures and determine the method for ensuring equitable implementation of these measures for the benefit of all North Carolinians. The CCAP, due July 5th, 2025, will update and expand upon North Carolina's existing climate strategies, ensuring that these documents align with the latest available science, modeling, and best practices. If awarded implementation funding, state-owned facilities in North Carolina may be eligible to receive funding for projects where greenhouse gas emissions can be substantially reduced, leading to further implementation of EO80 goals.

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 has applied for approximately $2.2 million in EECBG funding and is awaiting further potential

award information from the Department of Energy. If awarded, North Carolina will provide government agencies subgrants to implement energy efficiency measures and renewable energy system installations in their facilities, providing a direct funding pathway to help meet the EO80 goal of a 40% energy usage intensity reduction by 2025.

The SEO applied for and has been awarded the Preventing Outages and Enhancing the Resilience of the Electric Grid grant under the IIJA Grid Resilience Formula Grant Program Section 40101(d). The Grid Resilience grant provides approximately $9.2 million annually for the next five (5) years in funding support for the deployment of grid modernization technologies, diversification of distributed generation assets, and hardening and improving adaptivity of transmission infrastructure to strengthen the resiliency of the electric grid against disruptions from extreme weather-related events and outages. Potential projects from eligible entities, including electric grid operators, distribution providers, and others, will be prioritized based on North Carolina's objectives of grid modernization, equitable access to resilient and reliable energy, and equitable workforce development initiatives. In FY23-24, SEO will conduct outreach events with stakeholders and the public to determine stakeholder and community priorities for this funding, determine and share how project proposals will be evaluated and awarded, and release an RFP for proposals.

Several other clean energy funding programs within the IIJA are being explored as pathways to promote EO80 implementation, including State Energy Program (SEP) funding and the North Carolina Energy Efficiency Revolving Loan Program (Section 40502). North Carolina has been awarded $10.4 million in additional SEP formula funding from the IIJA over the next 5 years to promote clean energy initiatives throughout the state, such as workforce development, energy efficiency, transportation, energy resilience, etc, which may include clean energy initiatives within governmental entities to further EO80 energy reduction goals. Under the Energy Efficiency Revolving Loan Program, North Carolina would receive roughly $2.3 million to fund energy audits, upgrades and retrofits for commercial entities which includes public buildings, nonprofit organizations and the industrial sector. This program can consist of loans and up to 25% of the total award can be used for grants and technical assistance.

Guaranteed Energy Savings Contracts (GESC)

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 realized 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 financing method for energy efficiency improvements. To date, DOT has accumulated savings of more than $1.3 million above the guarantee for their two projects, and DPS has saved over $1.1 million above the guarantee for their project.[13] USI continues to oversee an additional seventeen projects within the UNC System that have an expected cumulated guaranteed savings of over $333 million through the life of the contracts.[14] With the success of these projects, DAC and DNCR are in the process of implementing GESCs for several of their facilities. The DAC project is for six 1,000 cell correctional facilities, and was recently approved at the September 12, 2023 Council of State meeting. The DNCR project includes the North Carolina Zoo, all three aquariums and five museums; their GESC is expected to be executed within FY23-24 pending Council of State approval. Both the DAC and DNCR GESCs combined are expected to save more than $70 million in energy savings over the life of the projects, a significant contributor toward the progress of EO80's goals.

Agencies and the UNC System have proven that GESC works and works well for completing energy projects. GESCs allow government entities to address issues associated with aging, inefficient buildings or equipment, high maintenance costs, and scarce budget resources through a unique funding mechanism that does not require any upfront capital, and provides guaranteed savings through a single vendor and a single contract. GESC continues to be a valuable method of analyzing, designing, and implementing energy improvement measures, and should be utilized to the maximum extent possible if EO80 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 a variety of requests including capital projects, maintenance issues, aging equipment, and infrastructure necessary to maintain the current use of existing facilities. USI and OSBM have worked together to ensure that agencies target a portion of these funds for energy efficiency measures. For example, during FY2021-22, cabinet agencies collectively leveraged up to $30 million in much needed funding for energy projects that were pre-approved by USI's technical staff. In the most recent 2023-25 North Carolina budget, $200 million was approved for repairs and renovations for both state agencies and UNC System facilities. USI will continue to work with OSBM to ensure that agencies target a portion of these funds for energy efficiency improvements. Overall, this is a positive step towards achieving greater efficiency gains and providing stewardship of taxpayer funds.

Duke Energy's Energy Efficiency Opt-In Program

Duke Energy allows customers to choose whether to "opt-in" and take advantage of demand side management (DSM) and energy efficiency (EE) programs. The purpose of these programs is to reduce energy consumption and improve the efficiency of electrical equipment. Participants generally pay slightly more on their 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

[13] We were unable to verify DOT's accumulated savings for their two GESCs since a final third-party review was not provided to DEQ for the most recent performance year (per NC GS143-64.17M). Savings provided are from the most recent completed performance year.

[14] 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.

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 DSM and/or EE programs and receive a monthly bill credit. Customers are encouraged to use these monthly savings to fund and implement their own efficiency measures. However, some customers that opt-out do not actually use their savings for energy efficiency measures as the program was intended; if governmental entities do choose to opt-out, it is important they are using those funds that would have otherwise been spent by opting-in, to actively and consistently fund energy efficiency improvements at their facilities. This can be accomplished by tracking a monthly "would be" spend amount in the same internal tracking mechanism used to track utility expenses, and ensuring these monies are actually set aside for energy efficiency expenditures.

Duke Energy's Small Business Energy Saver Program

Duke Energy's Small Business Energy Saver program pays up to 80% of the installation cost for energy efficiency improvements for eligible commercial customers with an average annual demand of 180 kilowatts or less. Duke Energy has a dedicated contractor that performs free energy assessments for potential program participants. Based on the assessment, energy efficiency recommendations are made related to lighting, refrigeration, heating and cooling, and water efficiency measures. 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 an upfront discount from Duke Energy to encourage the purchase and installation of high-efficiency lighting, HVAC systems, commercial and agricultural equipment, as well as equipment for eligible industrial and governmental facilities. Both DEQ and DPS have used this program successfully to upgrade lighting in several of their facilities within Duke Energy's service territory. The goal is that all eligible governmental entities will take advantage of this program when making energy efficiency upgrades in the future, where and when applicable.

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 energy efficiency projects. Over time, projects become larger thereby resulting in greater savings. For FY 2022-23, ten UNC System schools asked to carry forward over $17.2 million in savings and reported spending an additional $43.6 million for new energy efficiency projects; of this $43.6 million, $34.3 million is derived from new energy efficiency projects at Western Carolina University through the procurement of new high-efficiency boilers.[15] These funds are specifically designated for energy efficiency improvements.

[15] The values in this report reflect the most accurate tabulation of the "savings claimed" and "cost of new projects" for FY2022-23 based on datasets provided by participating UNC System schools.

Figure 7 shows the previous fiscal year's estimated avoided energy costs of the top agencies that totaled nearly $43 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 these avoided costs could have been utilized to self-fund additional energy efficiency projects similar to the UNC System and its affiliates. USI recommends cabinet agencies have access to similar self-funding energy efficiency improvement funds as the UNC System has through NCGS 116-30.3B, also known as "carry forward" funds; these funds would be significant and would provide a clear pathway to increased implementation of valuable energy efficiency projects.

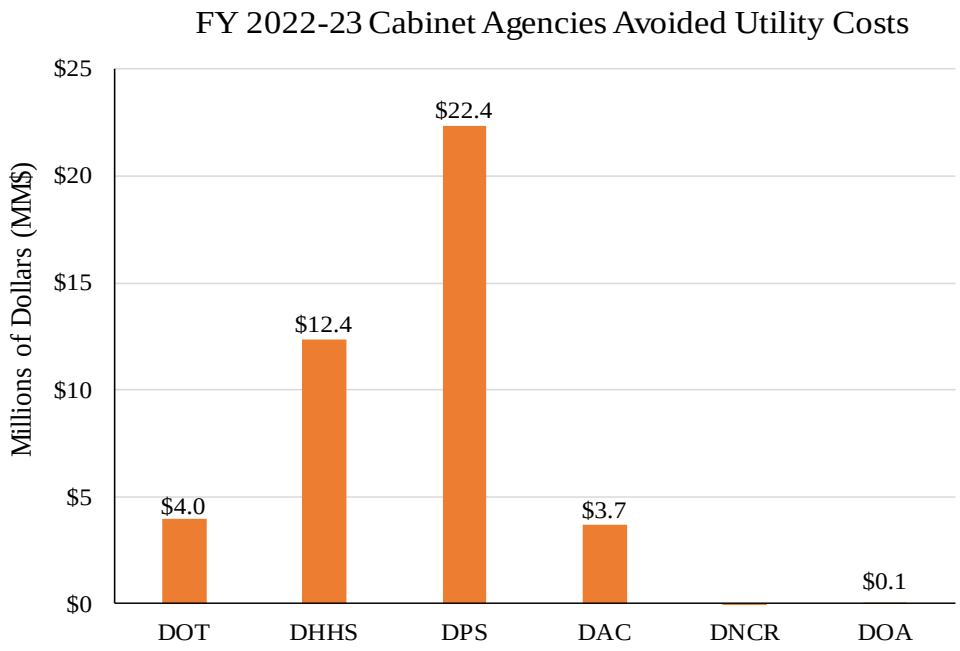


Figure 8: Cabinet Agencies Avoided Utility Costs

6.0 Best Practices for Leased Facilities

As USI continues to collect utility data from reporting entities, the subject of leased spaces remains. The annual report only collects utility data from state-owned buildings while excluding usage related to leased spaces. This decision was made as the reporting requirements were derived in GS 143-64.12. The primary reason is that the occupant of leased facilities lacks control of the type, style, or efficiency of the energy-consuming equipment within leased facilities. Secondly, most agencies lease only minimal space as needed and often for short terms. Over the years, government entities have requested specific requirements for these leased spaces, but energy related requirements have not been part of the prerequisites of those spaces. Often the energy efficiency of these spaces was not prioritized. With this knowledge, USI recommends leased spaces follow the same Recommended "Minimum Best Practices" for Stewardship of State-Owned Buildings as discussed in Section 5.1 of this report. These best practices should be requested whenever a leased space is being considered since they will indirectly promote the private sector to increase the efficiency of their buildings to obtain a state contract. Lease renewals are also a good time to negotiate and advocate for energy efficiency upgrades with building owners.

7.0 Eliminate Non-LED Lighting

The 2007 Energy Independence and Security Act established guidelines to reduce the wattage of incandescent bulbs, required the removal of magnetic ballasts, and set new standards for linear fluorescent lamps. Since 2007, there has been a continual shift in the market towards the elimination of older outdated lighting technology. In fact, in order to continue allowing the purchase of many of these outdated lamp technologies, manufacturers have creatively changed the names to designer lamps or labeled them as architectural. Meanwhile, prices have steadily climbed, and procurement has become more difficult. In 2021, a major lighting manufacturer announced an additional thirty percent price increase on non-LED lamps and ballasts to be effective in January 2022. This was on top of the price increases that have already taken place over the past decade. The message is clear that continued reliance on outdated lighting technology will result both in high costs from the energy to operate and from the price to purchase replacement bulbs. All state facilities that still use outdated technologies will pass this cost on to taxpayers until lighting upgrades are implemented.

With these increased costs and procurement difficulties, the time has come to move forward with newer LED lighting technologies. LEDs were invented in 1962 and have been around for more than sixty years. Originally as with any new technology, consumers were wary to adopt LEDs due to high prices and skepticism about manufacturer's quality. As a result, a group of utility companies in the northeast formed the Design Lighting Consortium (DLC) to create standards and performance requirements for LEDs. This has become the gold standard for LED lighting, and today, for any utility rebate to be obtained, the lamp or fixture must be DLC certified. This has cemented LED as a proven technology.

Most common linear florescent lamps have a rated wattage of 32 watts whereas the most common LED linear lamps have a rated wattage of only nine watts. When measuring the efficiency of a lamp, the lighting industry uses the term lumens per watt. This shows how much visible light is being delivered for a given amount of electricity. The higher the lumens per watt, the more energy efficient the lamp. A typical florescent 32-watt lamp will have an efficiency of 60 lumens per watt while a typical nine-watt LED lamp will have an efficiency of 110 lumens per watt. A fixture that has four 32-watt florescent lamps uses a total of 128 watts. The same fixture with four nine-watt LED will be using only 36 watts. That's a savings of 92 watts per fixture, and most office buildings have hundreds of fixtures. The math alone should prove that moving to LED is more cost effective on reducing the use of electricity.

Beyond the energy savings, moving to LEDs will have some additional benefits to any facility. Primarily, the longevity of LED lights leads to a drastic reduction in maintenance and labor costs due to increased bulb life. Secondarily, since new LEDs do not contain mercury like fluorescent bulbs, they are substantially more environmentally friendly. Lastly, LEDs provide better light quality and quantity as compared to older technology. Insufficient or improper lighting can create glares or reflections, making concentration and getting comfortable more difficult for employees. Poor lighting can also create workplace incidents or security risks due to lack of illumination. LED Lighting helps to mitigate all these issues.

There should be no reluctance to move all lighting away from older technologies; however, non-LED lighting continues to exist within many state-owned buildings. Steps need to be taken to remove and replace all non-LED bulbs and fixtures. At a minimum, state-owned buildings should stop purchasing inefficient, non-LED lamps and fixtures unless an exception is required for specialty circumstances and situations; this would require a directive against purchasing new non-LED lamps and fixtures. DPS/DAC is leading by example because they have initiated the "LED in'23" lighting campaign where their goal is to have every single building outfitted with LED lighting by the end of FY2023-24. The SEO recommends each state-owned building take the necessary steps to become more energy efficient and environmentally friendly by moving away from inefficient, non-LED lighting.

8.0 Conclusion

This report emphasizes the need for significant energy conservation measures and resources by all governmental units to achieve the EO80 40% EUI reduction goal by 2025. If substantial measures and resources are not implemented in FY2023-24, the EO80 40% EUI goal will likely not be achieved. Hiring full-time dedicated energy managers with decision-making authority and access to specific funding for energy improvements would help substantially in this effort. Management can empower these energy managers and fully support EUI reduction initiatives both by communicating energy efficiency goals and by providing leadership in making sure the goals are achieved. Energy managers and contacts within governmental units must engage and communicate with the USI team at the SEO consistently, who are there to provide technical assistance and guidance in all EUI reduction initiatives. Improved data collection efforts are underway within several state agencies, but all governmental units would benefit from a more sophisticated and centralized utility data collection system; this would reduce the risk of human error in data collection efforts, thereby increasing the accuracy and effectiveness of the data and allowing energy managers to more easily identify facilities that would benefit the most from energy efficiency efforts. Similarly, all governmental units need to consider alternative financing mechanisms for energy efficiency projects such as GESCs. A comprehensive and thoughtful utility management plan is also necessary for all governmental units to provide a long-term vision and structure for incorporating energy efficiency practices and principles into business decisions. Additionally, directives should be implemented to prevent purchasing non-LED lamps or fixtures throughout all government sectors, unless an exception is required for specialty circumstances or situations.

The State Energy Office (SEO) recommends the following overall improvements as it relates to energy efficiency for state-owned buildings:

- Invest in more sophisticated, state-of-the-art data collection tools and/or mechanisms to streamline and standardize utility data collection and increase the accuracy of the SEO's data collection efforts;
- Appoint a full-time energy manager, particularly for the top five largest agencies, where energy management is their sole responsibility;
- Maintain consistent and frequent communication with the SEO so we can better understand

and support USI entities' struggles and successes;

- Participate in energy efficiency assessments for state-owned facilities at least once every 3-5 years in order to identify and prioritize energy efficiency projects, and communicate these findings to the SEO;
- Explore and be creative with the various funding pathways for energy efficiency projects as outlined in Section 5.2, particularly with Guaranteed Energy Savings Performance Contracts;
- Implement a directive against purchasing new non-LED bulbs and/or fixtures, unless an exception is required for specialty circumstances or situations;
- The North Carolina General Assembly should consider establishing carry-forward funds for cabinet agencies as they have with UNC System institutions as a means of increasing funding and therefore implementation of energy efficiency projects.

Overall, cabinet agencies, other agencies, and the UNC System spent over $349MM on utilities in FY 2022-23. Proper stewardship of these funds requires robust energy conservation measures and a focus on energy efficiency. This message can 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 toward and reach the collective 40% EUI reduction goal by 2025. Now more than ever, an investment in energy efficiency is necessary for North Carolina to continue to lead-by-example both within our state and nationally. The USI team at the State Energy Office is prepared to support and assist with all energy efficiency efforts and to drive future energy savings across the state. We must continue to work together to conserve our valuable resources for the benefit of all North Carolinians.

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 Quinn and Ralph Taylor work together to improve the energy efficiency and sustainability of DOA facilities. DOA accounts for 12% of overall cabinet agencies' energy consumption impact.

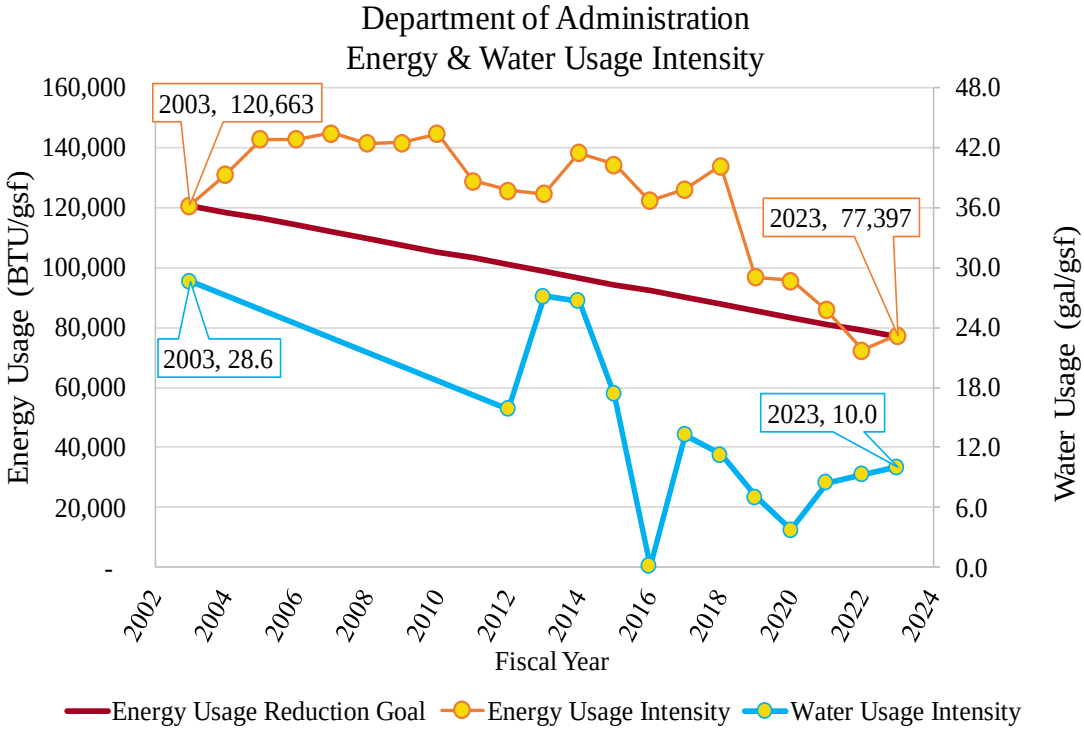


Figure A.1: DOA Utility Usage Over Time

Table A.1: DOA Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	4,798,719	5,686,982	+19%
Total Utility Cost	$7,491,785	$8,639,998	+15%
Energy Usage (Btu/gsf)	120,663	77,397	-36%
Energy Cost ($/MMBtu)	$12.41	$18.23	+47%
Water Usage (gal/gsf)	29	10	-65%
Water Cost ($/kgal)	$2.23	$10.80	+385%

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 is the Director of Support Services, and is designated as the energy manager for DES. DOC accounts for 1% of overall cabinet agencies' energy consumption impact.

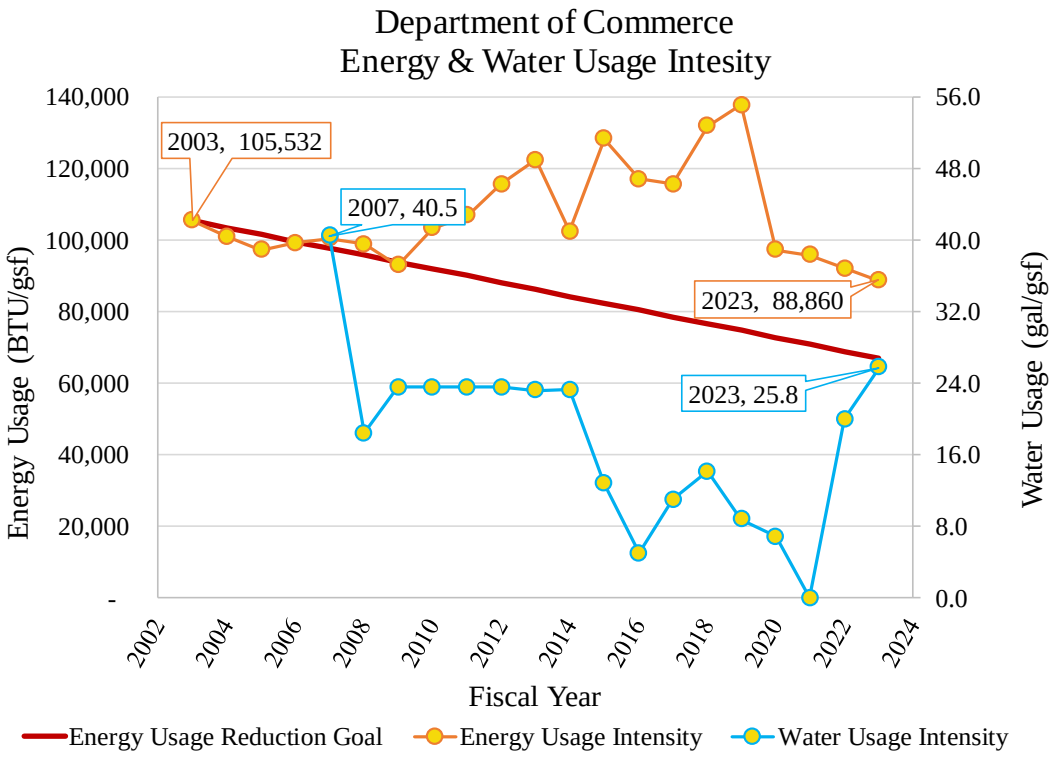


Figure A.2: DOC Utility Usage Over Time

Table A.2: DOC Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
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, which include the Reedy Creek complex located in Raleigh primarily occupied by the Division of Air Quality, and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. Eric Turon based in Raleigh is the Division Director for DEQ's Division of Facilities Health & Safety. 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. Water consumption was not available for DEQ's Reedy Creek complex for FY2022-23. DEQ accounts for less than 1% of overall cabinet agencies' energy consumption impact.

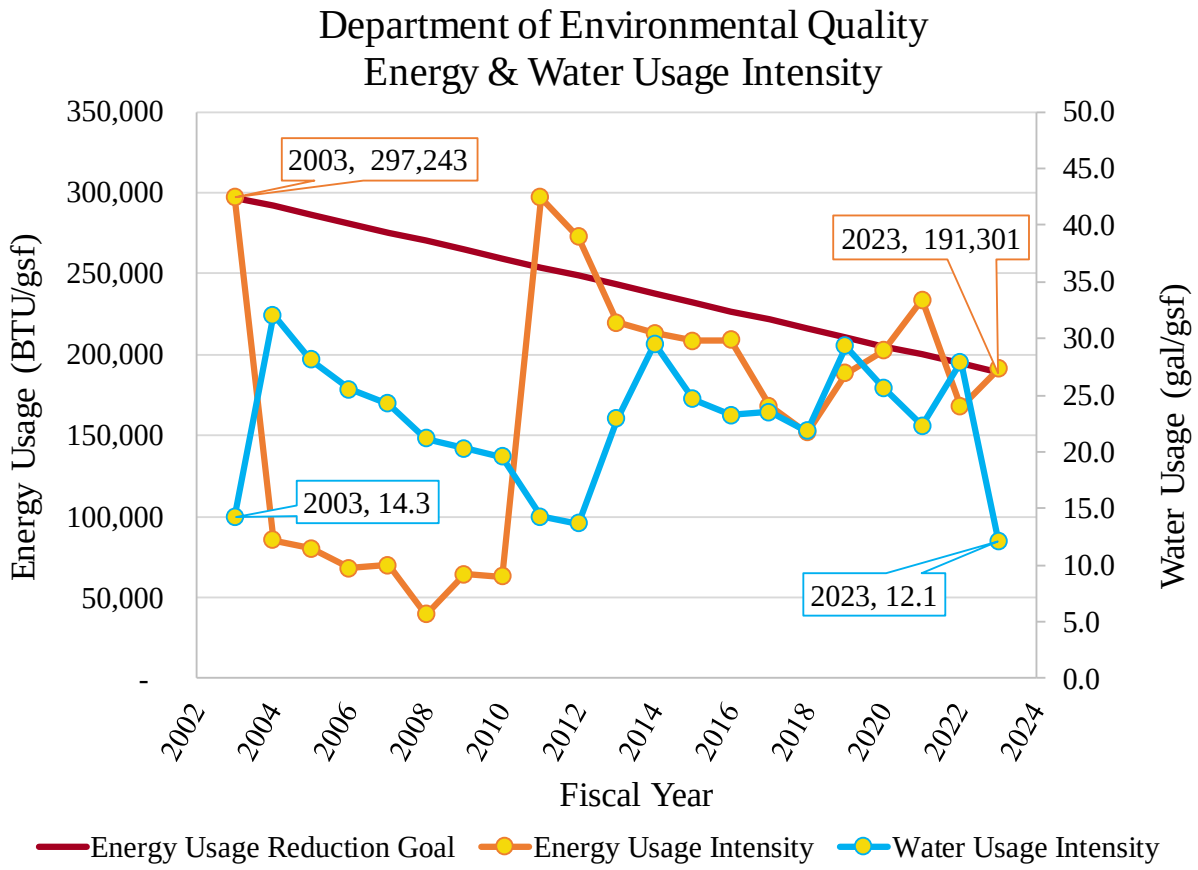


Figure A.3: DEQ Utility Usage Over Time

Table A.3: DEQ Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	105,527	95,182	-10%
Total Utility Cost	$572,246	$347,453	-39%
Energy Usage (Btu/gsf)	297,243	191,301	-36%
Energy Cost ($/MMBtu)	$17.56	$18.31	+4%
Water Usage (gal/gsf)	14	12	-15%
Water Cost ($/kgal)	$14.21	$12.19	-14%

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 Managers for DHHS are Greg Johnson, Luke Hoff, and Bill Stevens within the Division of Property and Construction. DHHS accounts for 21% of overall cabinet agencies' energy consumption impact.

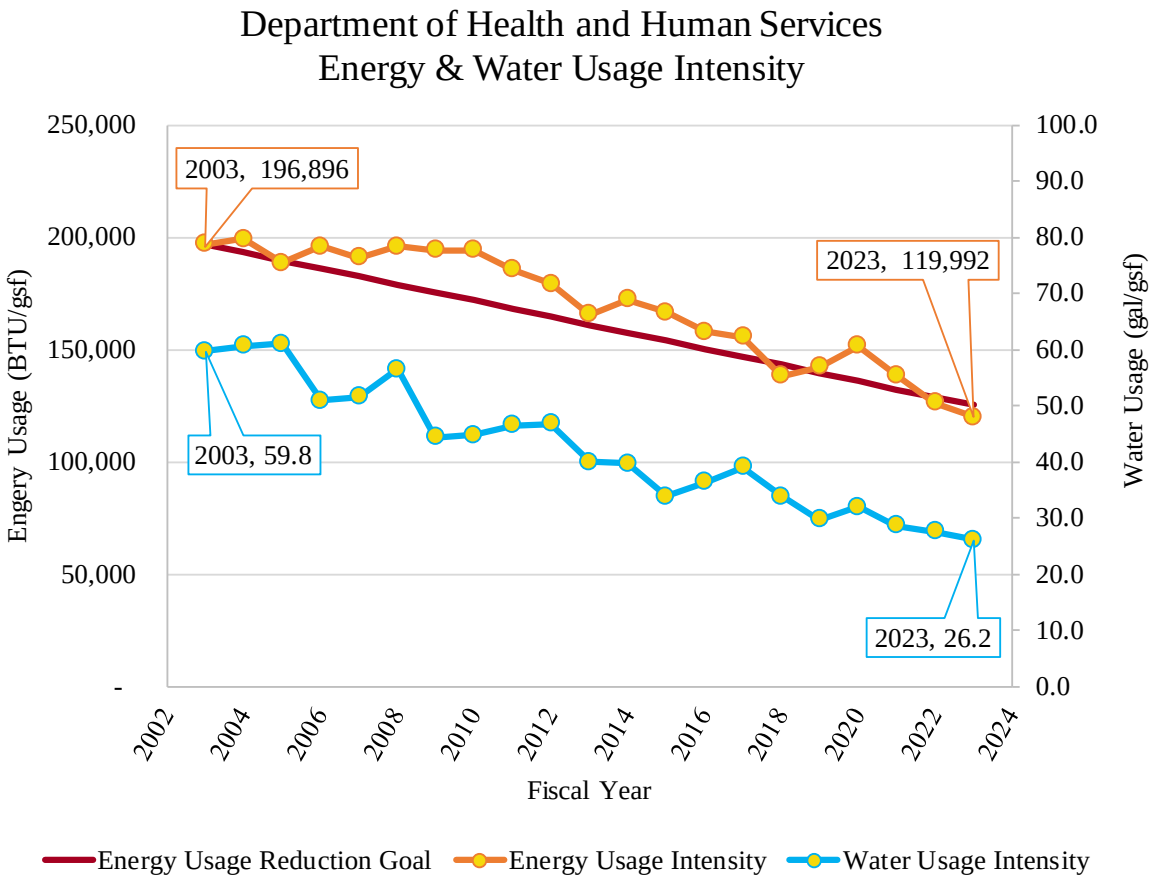


Figure A.4: DHHS Utility Usage Over Time

Table A.4: DHHS Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	6,381,007	7,926,889	+24%
Total Utility Cost	$12,834,405	$17,099,675	+33%
Energy Usage (Btu/gsf)	196,896	119,992	-39%
Energy Cost ($/MMBtu)	$9.23	$15.67	+70%
Water Usage (gal/gsf)	60	26	-56%
Water Cost ($/kgal)	$3.25	$10.59	$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. DIT accounts for roughly 1% of overall cabinet agencies' energy consumption impact.

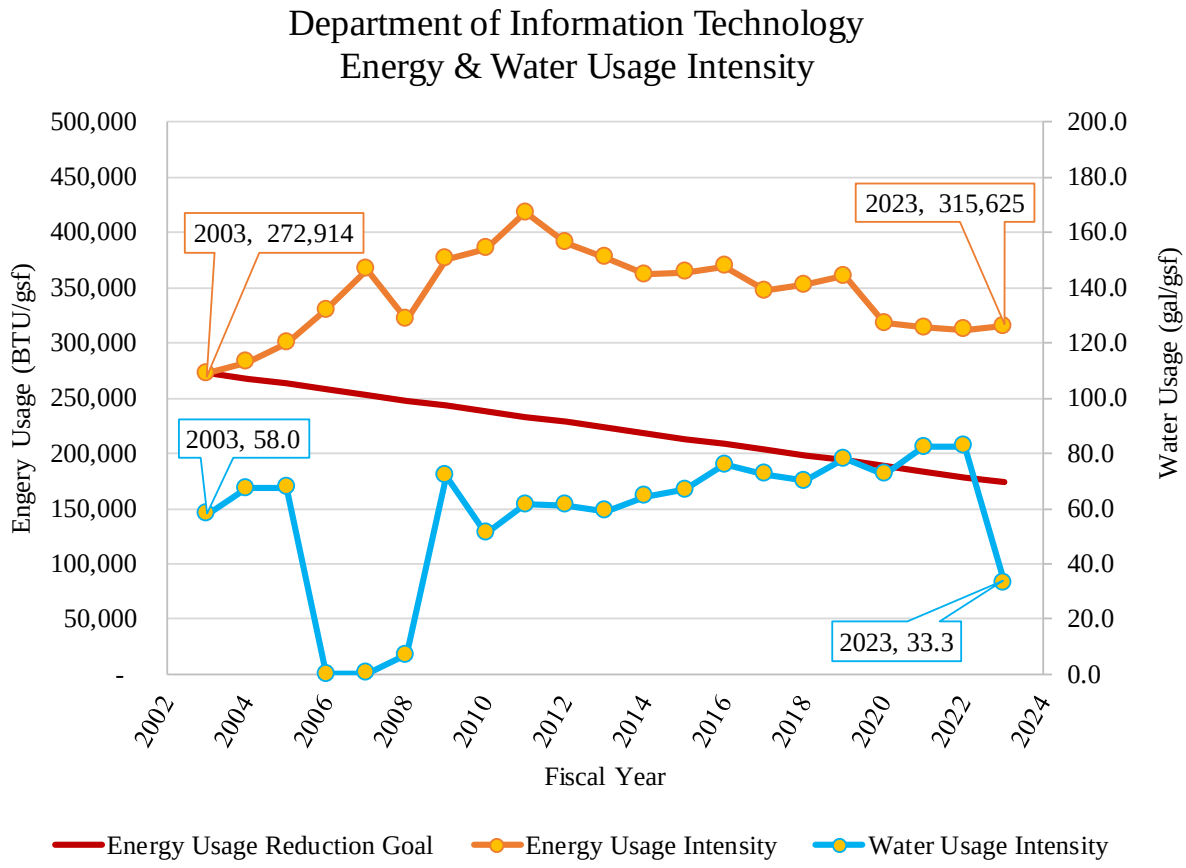


Figure A.5: DIT Utility Usage Over Time

Table A.5: DIT Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	94,343	163,866	+74%
Total Utility Cost	$362,255	$1,138,371	+214%
Energy Usage (Btu/gsf)	272,914	315,625	+16%
Energy Cost ($/MMBtu)	$13.67	$20.60	+51%
Water Usage (gal/gsf)	58	33	-43%
Water Cost ($/kgal)	$1.90	$13.34	+602%

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 annually. The energy managers are Cecil Holt and Jackie Bond. Mr. Holt is the DMVA Chief of Property & Construction, Consulting Services Section of the State Construction Office.

Previous reports indicated that DMVA utilities are paid through federal funds and therefore they did not have utility graphs/tables to report; however, the SEO was informed in late June 2023 that DMVA nursing homes and cemeteries *are* paid with state funds and therefore should be included in reporting efforts. The SEO received incomplete energy consumption data from DMVA for FY2022-23; we will continue to work with DMVA's energy managers to generate a complete report for next year's FY2023-24 report, which will give insights into the Department's contributions to agency totals.

Department of Natural and Cultural Resources (DNCR)

The NC 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 NC Zoo, the NC Symphony, the State Library, the State Archives, the NC 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 1,825 buildings across the State

which account for over three million gross square feet of space. Tony Romaine is the energy manager for DNCR, serving as the Construction Project Manager of the Capital Projects Unit. 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. DNCR accounts for 7% of overall cabinet agencies' energy consumption impact.

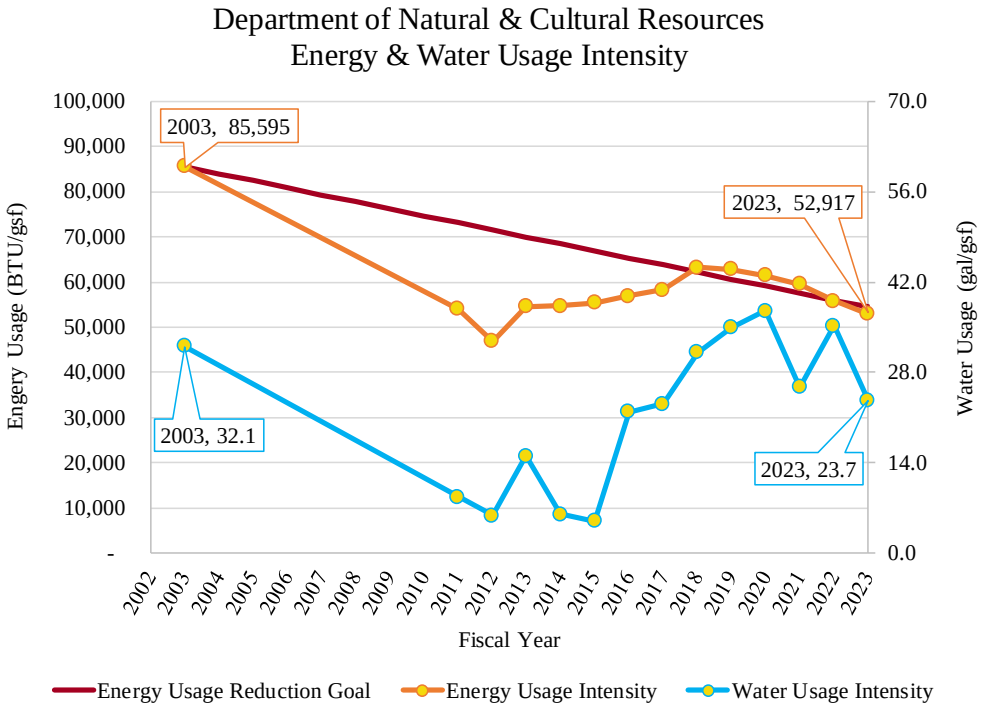


Figure A.6: DNCR Utility Usage Over Time

Table A.6: DNCR Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	2,291,088	3,679,750	+61%
Total Utility Cost	$3,808,442	$6,486,632	+70%
Energy Usage (Btu/gsf)	85,595	52,917	-38%
Energy Cost ($/MMBtu)	$17.08	$27.54	+61%
Water Usage (gal/gsf)	32	24	-26%
Water Cost ($/kgal)	$6.25	$12.91	+107%

Department of Transportation (DOT)

The NC Department of Transportation 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 NC State Port Authority (NCSPA), NC Global TransPark and NC Turnpike Authority. DOT combined with the NCSPA occupies a total of 2,382 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. DOT accounts for 15% of overall cabinet agencies' energy consumption impact.

It should be noted that the SEO did not receive any utility usage information from DOT for FY2022-23. Energy and water consumption data was duplicated from FY2021-22 to carry forward their approximate usage in order to make reasonable assumptions based on their contribution to agency totals.

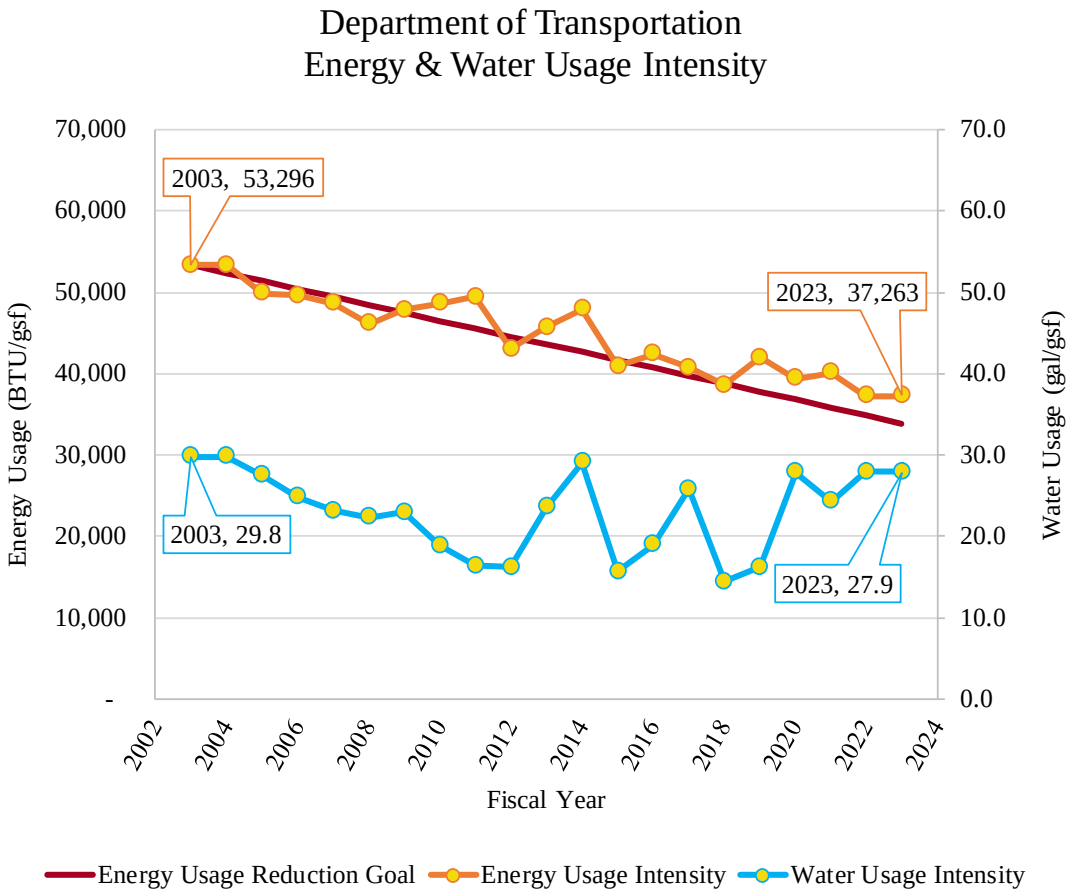


Figure A.7: DOT Utility Usage Over Time

Table A.7: DOT Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
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 in Raleigh. 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 is designated as the energy manager for DOR, his primary role serving 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 has 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. DPS accounts for 43% of overall cabinet agencies' energy consumption impact.

It should be noted that DPS and DAC formally split and became separate departments on January 1, 2023. Paul Braese is now the Energy Manager for DAC, while an energy manager for DPS is not yet identified. The SEO will continue to work with both departments in FY2023-24 to formally split their energy consumption details for next year's report, however this current report still includes DAC within DPS' overall energy consumption. The SEO recommends DPS work toward identifying and hiring a contact to serve as a full-time energy manager.

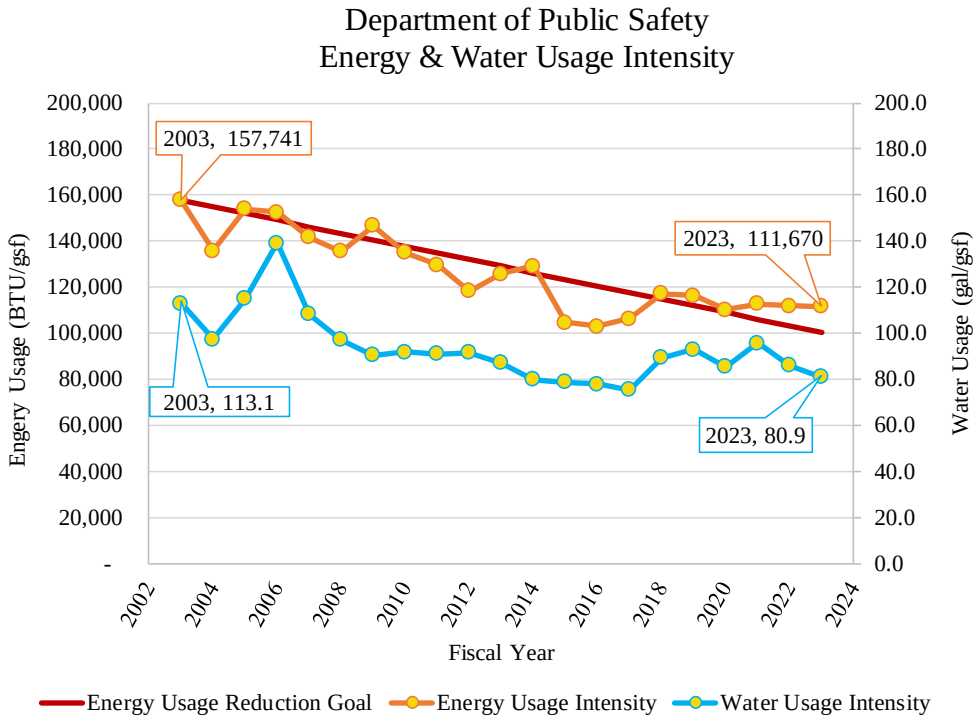


Figure A.8: DPS Utility Usage Over Time

Table A.8: DPS Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	11,581,135	16,943,880	+46%
Total Utility Cost	$32,284,715	$55,023,684	+70%
Energy Usage (Btu/gsf)	157,741	111,670	-29%
Energy Cost ($/MMBtu)	$12.43	$17.61	+42%
Water Usage (gal/gsf)	113	81	-28%
Water Cost ($/kgal)	$7.31	$15.83	+116%

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. The energy manager for DA&CS is Wendy Dudka.

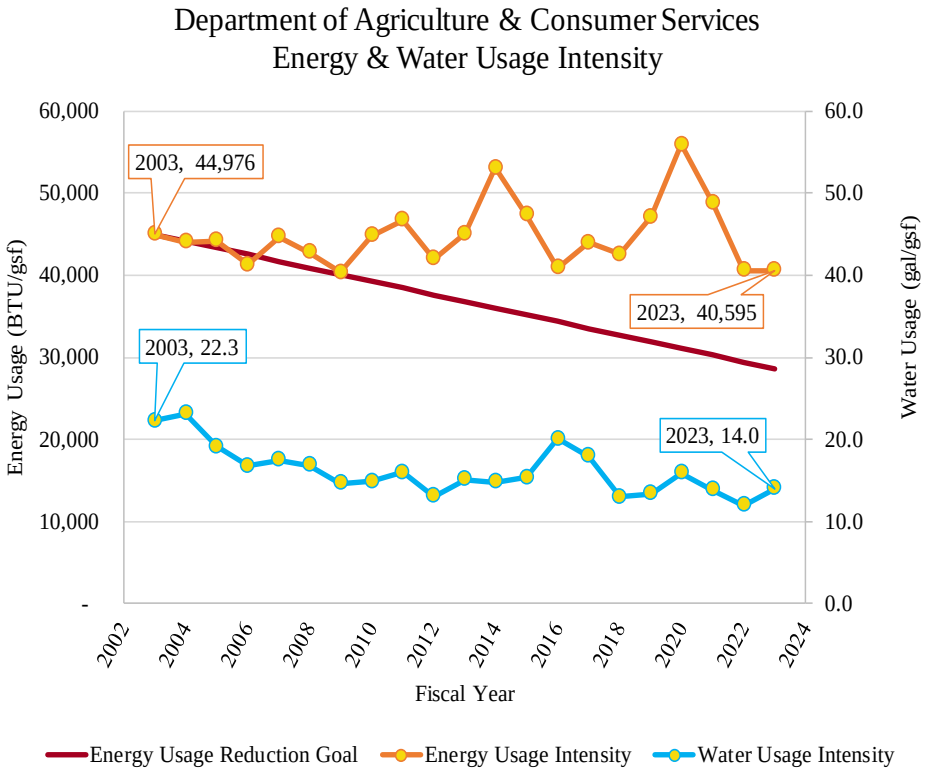


Figure A.9: NCDA&CS Utility Usage Over Time

Table A.9: NCDA&CS Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	2,995,262	4,437,478	+48%
Total Utility Cost	$2,374,024	$5,151,269	+117%
Energy Usage (Btu/gsf)	44,976	40,595	-10%
Energy Cost ($/MMBtu)	$15.41	$21.90	+42%
Water Usage (gal/gsf)	22	14	-37%
Water Cost ($/kgal)	$4.47	$18.66	+318%

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. The energy manager for DOJ is Greg Raynor.

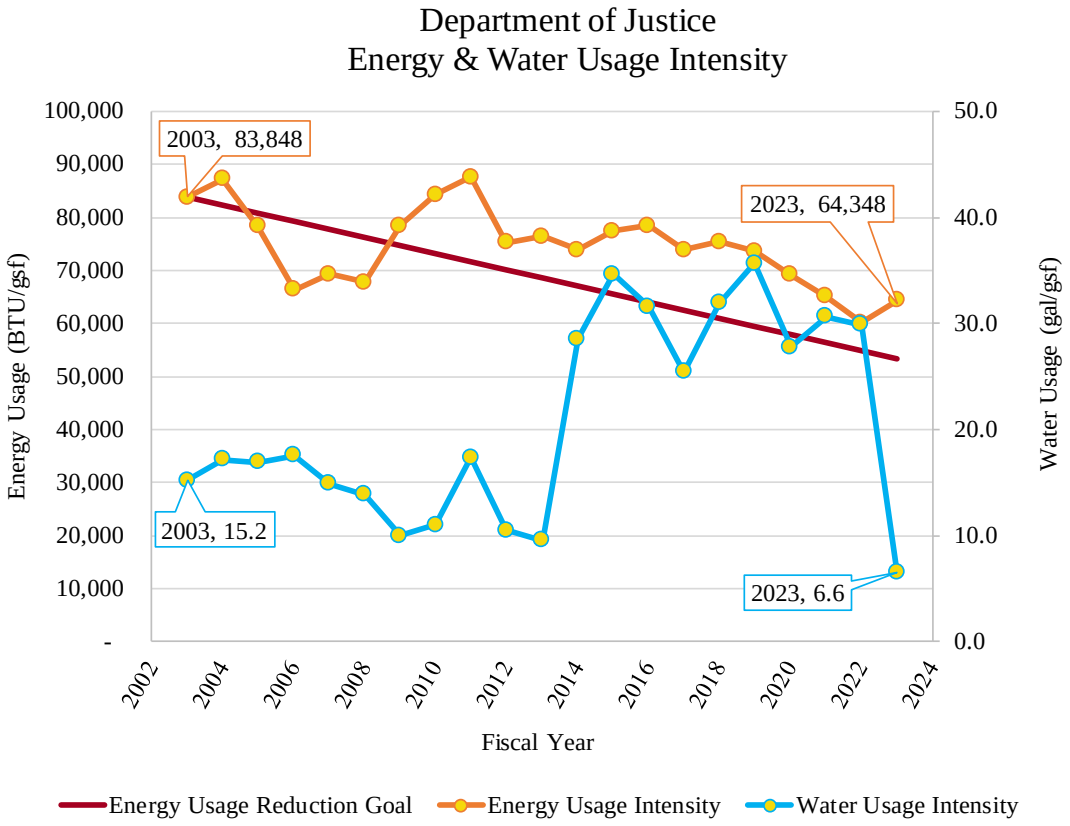


Figure A.10: DOJ Utility Usage Over Time

Table A.10: DOJ Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	204,206	298,220	+46%
Total Utility Cost	$269,833	$565,716	+110%
Energy Usage (Btu/gsf)	83,848	64,348	-23%
Energy Cost ($/MMBtu)	$15.09	$25.38	+68%
Water Usage (gal/gsf)	15	7	-57%
Water Cost ($/kgal)	$3.71	$40.21	+985%

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. Nathan Maune is assigned as the primary departmental energy manager for the DPI.

It should be noted that DPI's NCCAT and NCSD campuses were not included in FY2022-23 data due to the delay in receiving data for these campuses, hence the spike in EUI as seen below. This is due to the gross square footage from Western School for the Deaf (WNSD) being the only campus represented in FY2022-23's data. Next year's report will incorporate FY2022-23 data from NCCAT and NCSD, and will more accurately reflect this fiscal year's numbers.

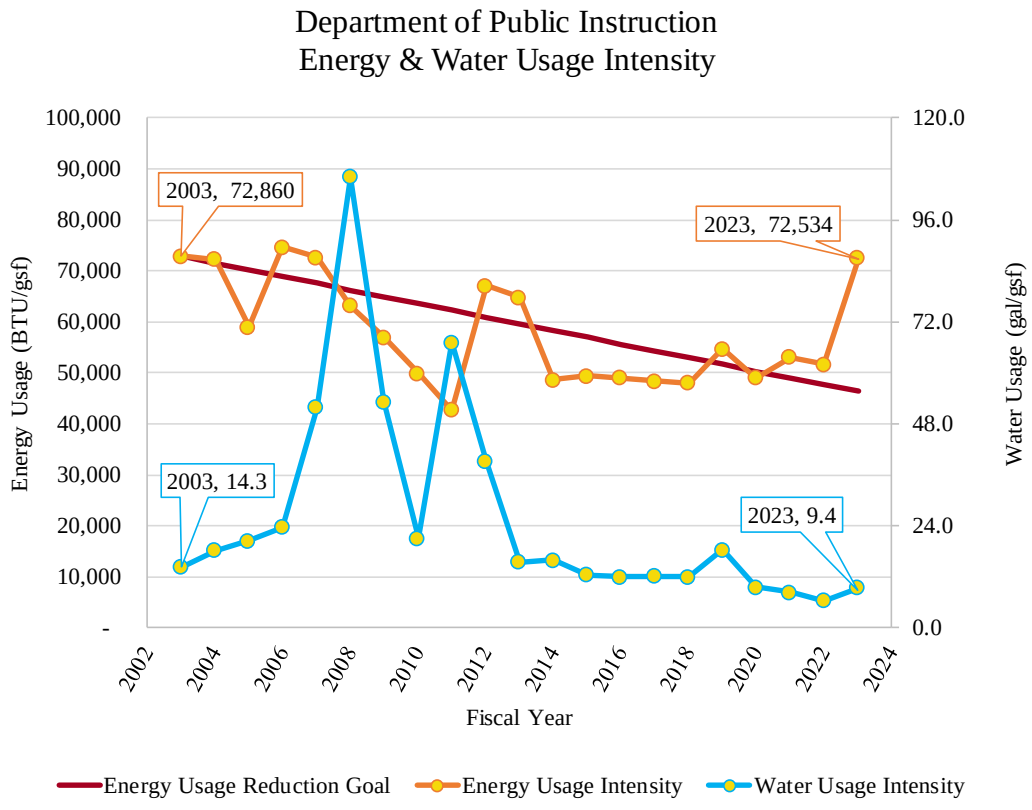


Figure A.11: DPI Utility Usage Over Time

Table A.11: DPI Progress

Metric	Fiscal Year		% Change
	2002-03	2022-23	
Total Gross Square Feet	713,347	291,112	-59%
Total Utility Cost	$747,574	$423,172	-43%
Energy Usage (Btu/gsf)	72,860	72,534	-0%
Energy Cost ($/MMBtu)	$12.91	$19.05	+48%
Water Usage (gal/gsf)	14	9	-34%
Water Cost ($/kgal)	$7.47	$7.58	+2%

Wildlife Resources Commission (WRC)

The NC 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. The energy manager for WRC is Gary Gardner, Chief of Engineering for WRC.

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

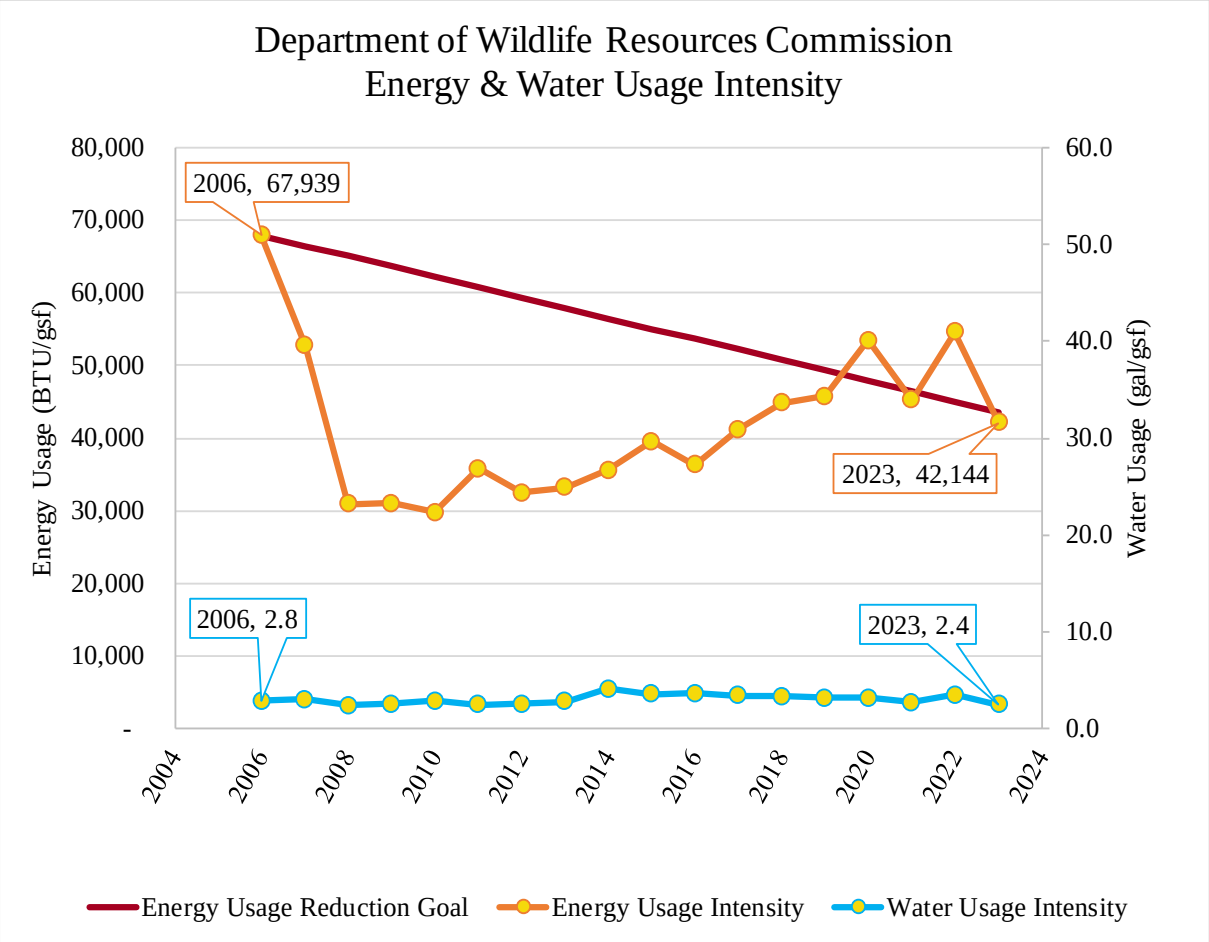


Figure A.12: WRC Utility Usage Over Time

Table A.12: WRC Progress

Metric	Fiscal Year		% Change
	2005-06	2022-23	
Total Gross Square Feet	161,093	316,934	+49%
Total Utility Cost	$222,601	$380,220	+41%
Energy Usage (Btu/gsf)	67,939	42,144	-61%
Energy Cost ($/MMBtu)	$20.00	$26.59	+25%
Water Usage (gal/gsf)	3	2	-17%
Water Cost ($/kgal)	$8.18	$32.65	+75%

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, 2023, 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"*[16] (SIT) and the *"Emissions & Generation Resource Integrated Database"*[17] (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"*[18] 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:

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

[16] https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[17] https://www.epa.gov/egrid/download-data
[18] 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	0.000324215	0.005318772	0.010317173	0.011304793	0.005706251
2020-21	0.000299371	0.005318772	0.010317173	0.011304793	0.005706251
2021-22	0.000303907	0.005318772	0.010317173	0.011304793	0.005706251
2022-23	0.000303907	0.005318772	0.010317173	0.011304793	0.005706251

Table B.2: State Inventory and Projection Tool Emission Factors[19]

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

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

Propane	0.005666907	MTCO2e/ gal	2.29578E-05	MTCO2e/ gal	1.63867E-05	MTCO2 e/gal

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 FY2022-23 Avoided Greenhouse Gas Totals

Fuel Source Usage	Cabinet Agencies (MTCO2e)	Other Agencies (MTCO2e)	UNC System (MTCO2e)	All State Government Units (MTCO2e)
Electricity	2,332,419	21,454	5,957,006	**8,310,880**
Nat Gas	-135,752	28,229	-302,730	**-410,252**
Fuel Oil	662,014	-3,128	1,482,493	**2,141,379**
Propane	62,980	-527	-238	**62,216**
Total	**2,921,662**	**46,028**	**7,136,532**	**10,104,222**

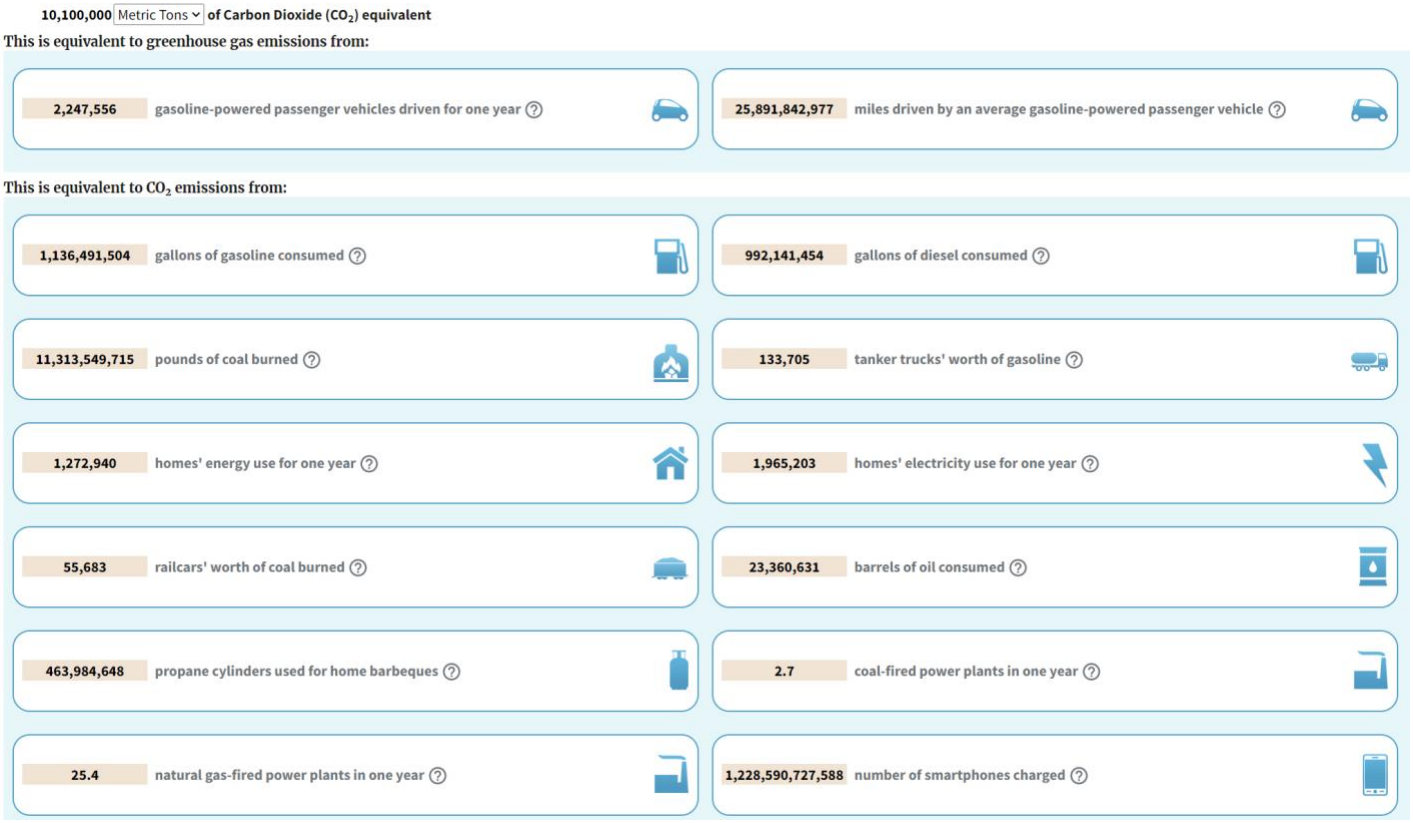
Table B.4: FY2022-23 Avoided Greenhouse Gas Totals

Fuel Source Usage	Cabinet Agencies (MTCO2e)	Other Agencies (MTCO2e)	UNC System (MTCO2e)	All State Government Units (MTCO2e)
Electricity	250,809	1,853	664,900	**917,562**
Nat Gas	12,812	1,114	-37,334	**-23,408**
Fuel Oil	45,566	-225	92,653	**137,995**
Propane	8,946	-40	296	**9,202**
Total	**318,133**	**2,703**	**720,515**	**1,041,351**

Greenhouse Gas Equivalencies

Figure 1 contains a screenshot of the USEPA's greenhouse gas equivalencies calculator[20] 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



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

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