



EXECUTIVE ORDER 80 ENERGY & WATER MANAGEMENT PLAN

Revision 1

SEPTEMBER 16, 2020
CENTRAL ENGINEERING
2020 Yonkers Road, Raleigh, NC 27699

Executive Summary:

GS 143-64 requires all agencies reduce energy and water *intensity* by 30%¹ by 2025. Governor Cooper's Executive Order 80 increases this requirement to 40%² by FY 2025-2026. NCDPS is struggling to attain these targets (see **Graph 1A** and **1B**) even though efforts have intensified substantially since FY 2017-2018 (**Appendix A**). NCDPS currently stands at an 19 % energy and 12 % water reduction compared to FY 2002-2003³. By comparison, the department *peaked at a 22% and a 23% reduction respectively in FY 2016-2017. The department's annual water & sewer expenditure is about the same as electricity - and even higher for correctional facilities. For this reason, the focus must be equally on energy and water reductions in intensity. A challenge to reducing intensities is that ~40% of correctional spaces are not air conditioned and lack sufficient security lighting; moreover, when NCDPS begins addressing these basic operational shortfalls, it will only serve to delay achievement of the targets.*

Attaining these targets requires aggressive action:

- Saving approximately 87 MMBTU every year for the next six years based on current usage intensity.
- This translates to investing approximately \$13.5M a year in water and energy efficiency projects⁴, or \$81M over the next 6 years. Projects both funded and unfunded needed to attain these targets are provided in **Appendix B**. *Aggressive leak detection and repair could noticeably reduce overall project funding needs.*
- Hiring additional staff to manage these projects and properly maintain facility systems.
- Leadership buy-in and promotion of commission-based maintenance over break-fix.

Legislation like HB 1292⁵ for cabinet agencies would accelerate these efforts. Several universities have taken advantage of this bill and have surpassed the desired 40% reduction in water & energy intensity.

Attaining these targets have tremendous tangential benefits:

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

Attaining these target reductions are challenging for several reasons:

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

¹ Session Law 2008-203/Senate Bill 1946: Intensity is the energy and water use per square foot.

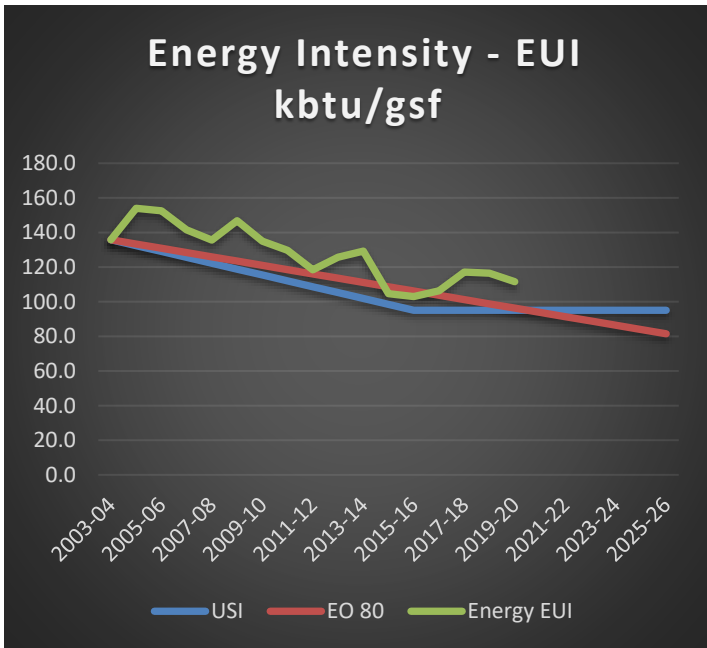
² Compared to our energy/water intensity (usage per gross square foot) in FY 2002-2003. See also Footnote 3.

³ There is insufficient data to establish a FY 2002-2003 baseline. So, FY 2003-2004 is being used. See also Footnote 2.

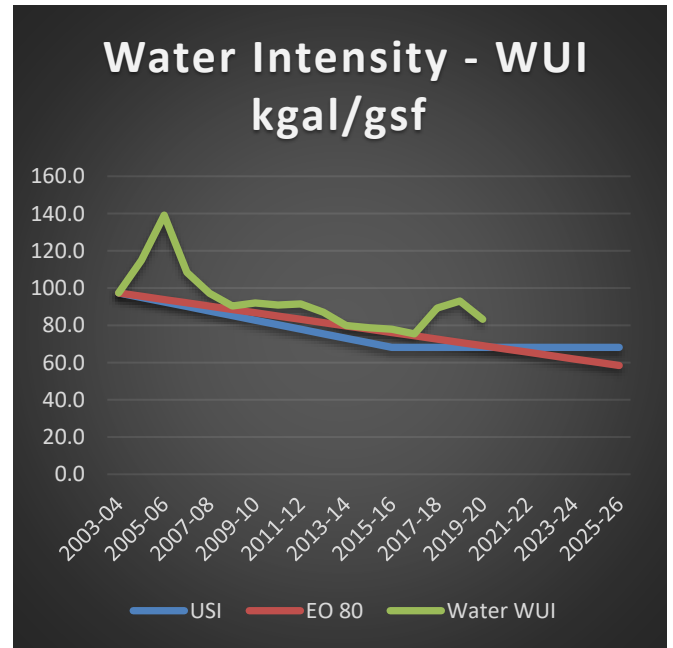
⁴ This is an "order of magnitude" estimate. Our current level of project investment is \$1M a year, or around 10% of what is required.

⁵ HB 1292 allows universities -but not other state agencies - to use energy efficiency savings from completed projects for new energy efficiency projects. Utility budgets are maintained at "pre-energy efficiency project" funding levels.

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



Graph 1A



Graph 1B

Accomplishments FY 2019-2020:

Funding:

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

Analyses:

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

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

Staffing: Energy Management: The team has increased in size from 1 full time equivalent employees (FTE⁶) to 2.75 FTE with the hiring of a project manager for exterior lighting projects and a ¾ time college intern. These positions are temporary employees funded through Opt-Out credits and subject to disruptions created by frequent turnover. Adult Corrections (AC) is in the final stages of hiring an Energy & Sustainability Manager for the Department of Prisons. These hires will accelerate our interior lighting projects, allow us to formally develop a water leak detection, and, maintenance-based commissioning (MBC) program.

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

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

Projects:

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

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

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

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

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

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

Goals FY 2020-2021:

Funding:

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

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

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

Analyses:

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

Staffing:

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

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

Projects:

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

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

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

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

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

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

Challenges

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

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

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

Opportunities:

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

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

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

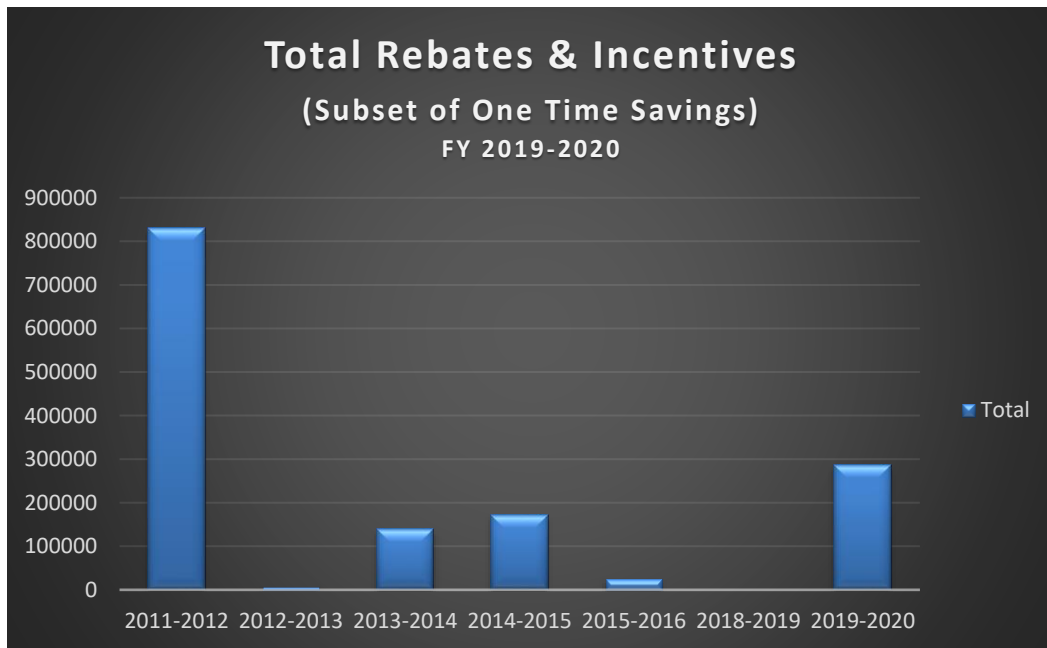
- What sites have the most unairconditioned bed count? (and will require future cooling and energy use)
- What sites have the highest water/sewer, and, electrical costs per unit? (Electric Coops generally have higher rates. Water/sewer rates are generally higher when we are the primary or only industrial/commercial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

-End-

Relevant Charts

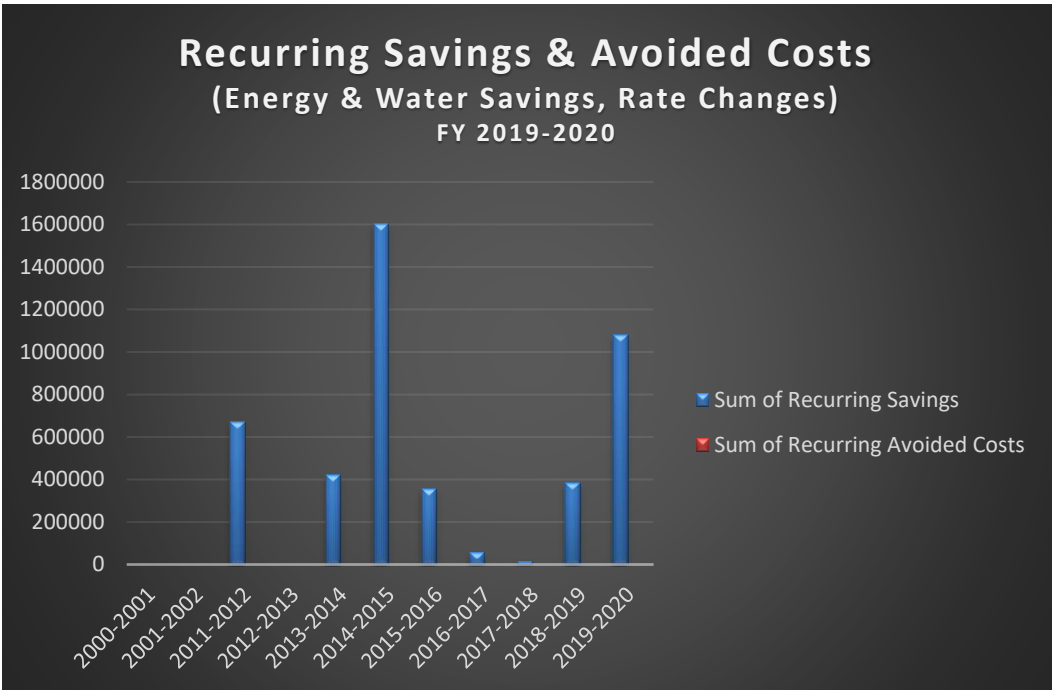


Note increase in Opt-Out credits as the program matured, and rebates/incentives received from Small Business Energy Savers incentives this past fiscal year.

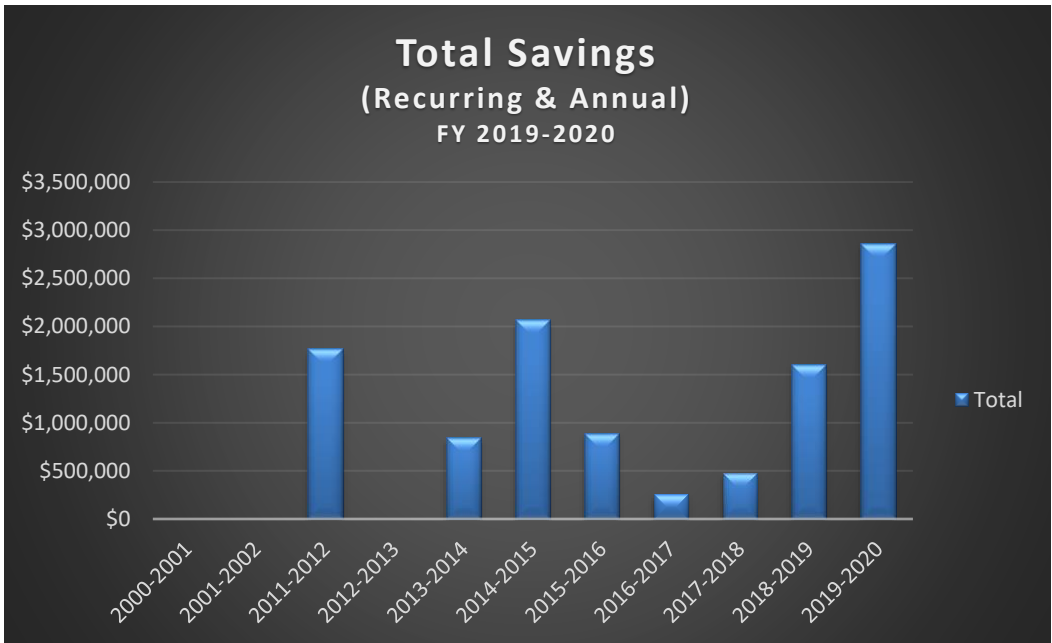


Rebates/Incentives are a sub-set of Yearly One Time Savings. Small Business Energy Savers Program are primarily responsible for FY 2019-2020 increase, though a \$32k rebate was received for LED lighting retrofits at Alexander CI.

Relevant Charts

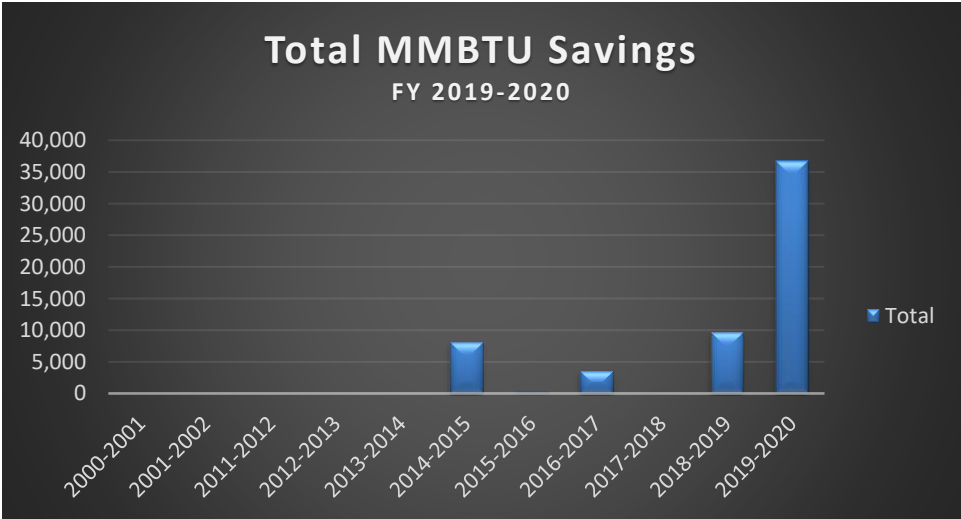


Note increase in recurring savings due to energy/water efficiency. Peaks in 2011-2012 and 2014-2015 reflect the America Recovery & reinvestment Act (ARRA) funded projects and NORESKO projects respectively.



Note increase in yearly savings over the past three years.

Relevant Charts



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

Interior Lighting Retrofit Example:

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

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

Before LED Retrofit



After LED Retrofit



Project improved visual acuity and dramatically reduced the exterior lighting maintenance

Thousand Cell Exterior Lighting Retrofits



Before...

After...

85% Reduction in Energy Use

**Project improved visual acuity, enhanced site safety, and dramatically reduced the exterior lighting maintenance
Special thanks for all the site and regional maintenance team members responsible for installing these light fixtures**

Thousand Cell Exterior Lighting Retrofits



Before...



After...



After...



Thousand Cell Exterior LED Lighting

82% Power Reduction

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

Appendix A
Historic Efforts to Attain Energy & Water Reduction Targets

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

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

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

Appendix B:

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

Project Summary: Funded and Unfunded				
Project Summary	Project Costs:	Recurring Savings:	Kgal Reduction	Sum of Total Energy MMBTU
2020-2021				
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
LED Exterior Lighting Retrofit	\$597,070	\$127,426		5,996
Stormwater Fee Elimination	\$1	\$29,880		0
2021-2022				
Exterior LED Lighting Lamp Replacements	\$500,000	\$115,696		5,179
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
Rockingham Duke energy analyses and savings	\$239,042			1,416
Rockingham Duke rebate				0
2022-2023				
Exterior LED Lighting Lamp Replacements	\$500,000	\$115,696		5,179
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
2023-2024				
Exterior LED Lighting Lamp Replacements	\$500,000	\$115,696		5,179
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
2024-2025				
Exterior LED Lighting Lamp Replacements	\$500,000	\$115,696		5,179
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
Interior LED Lighting Retrofits	\$9,061,169	\$5,923,363		264,083
Water Management System = to ICON	\$17,065,142	\$2,059,024	173,200	0
2025-2026				
Exterior LED Lighting Lamp Replacements	\$500,000	\$115,696		5,179
Interior LED Lighting Lamp Replacements	\$226,000	\$125,508		6,548
Water Management System = to ICON	\$31,008,198	\$3,741,347	314,713	0
Additional HVAC Projects to Attain Goal: Energy	\$19,605,668	\$4,155,986		185,800
Grand Total	\$81,432,290	\$17,368,554	487,913	522,476
These projects are anticipated to be funded through Opt-Out Funds				
These are unfunded projects needed to attain our 40% reductions.				

Appendix C: Sustainability Opportunities

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

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

--End--