Strategic

Energy Plan

2021 UPDATE

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Executive Summary

Campus Energy Overview

Size and Growth

UNC Charlotte is an urban research-intensive university, located primarily on a 1,000-acre campus in the state's largest city. In the Summer of 2021, the University had a campus community (students, faculty, and staff) of approximately 33,300 with nearly ten (9.97) million gross square feet (GSF) of built space, including parking decks. Plans continue for an enrollment increase to approximately 35,000 students in the next (5) years. Additional Academic / Research, Auxiliary Services and Residence Life space continue to be built to support campus population growth.

Since 2003, the full time equivalent (FTE) Faculty / Staff campus population has grown to 3,700 and built space has more than doubled. In that same period, energy consumption has grown by 45%, and energy costs have grown by 75%; however, energy consumption per GSF has fallen by 38%. Although, the university strives to reduce energy consumption in campus facilities 2021 may not be indicative of actual performance do to operation changes associated with COVID-19.

Energy Systems

Building heating and cooling requirements are provided by a combination of Regional Utility Plants (RUPs) and HVAC systems dedicated to specific buildings. Regional Utility Plants are designed and constructed to provide energy efficient distribution of chilled water and hot water to multiple buildings. The conversion from steam heat is nearly complete. Small steam boilers are still in use in 2 buildings. The new RUP5 is now up and running, supporting the core campus buildings that used the Main Plant Steam.

The majority of main campus is primarily served by a single electrical substation. Given the emerging potential for energy conservation, the university may be able to meet future growth with its current electrical substation, thus saving substantial infrastructure costs and land. One emerging challenge could be to meet electricity demand if electrification of current natural gas-fueled equipment is pursued to meet climate goals and/or required in modernized building codes.

Energy Conservation Challenges, Accomplishments and Goals

Accomplishments and Goals

UNC Charlotte's energy use reduction of 38% per building GSF provided an avoided cost of approximately $5.5 million this year alone over the 2003 baseline. New buildings continue to have energy recovery and high efficiency equipment / systems installed. As noted previously these results may not be indicative of actual performance due to operational changes to facilities associated with COVID-19.

Funded through a combination of Performance Contracting, Operational and Repair and Renovation funds, significant energy reduction will continue through:

- ASHRAE Level II Energy Audits
- Tuning of buildings to actual requirements versus design assumptions
- System retrofit modifications such as high efficiency motors, VFDs, LED lighting
- HVAC scheduling for occupancy
- Awareness training

The University is now in Year 7 of its "Guaranteed Energy Savings Performance Contract" w/ Year 6 M&V verifying $66,048 and Year 7 M&V non-verified $64,981 in excess savings. The "Performance Contracts" through Ameresco and JCI (UNC – Gen. Admin. Lighting) continue to provide energy savings through the energy related capital improvements to roughly twenty-eight (28) different campus facilities.

Web based monitoring continues to be provided on all new buildings and on existing buildings undergoing major renovations. State-of-the-art DDC Control Systems with utility monitoring and trending are also used.

Retro-Commissioning and building energy audits continue to be a priority as funding becomes available. Retro-Commissioning will be prioritized at the RUP facilities and will be performed at other facilities only after ASHRAE Level II energy audits have been completed on the facility.

The University continues to add utility monitoring to existing buildings that do not have active water, electricity, chilled or hot water BTU meters and natural gas pulse units. Older meters are being replaced with new meters that have the capability to communicate to the existing Building Automation System (BAS), which allows trending and archiving of energy usage data. Keeping the BAS and existing energy meters on campus operational and properly communicating is an ever increasing (on-going) challenge as well.

North Carolina G.S. 143-64.12 and LEED principles for sustainability, particularly relating to energy and water use, are included in the UNC Charlotte Design and Construction Manual. UNC Charlotte has (10) certified green buildings to date (5 LEED, 5 Green Globes) and is currently pursuing Green Globes certification for the new Science Building and Phase XVI Housing . Since the first campus building was certified under LEED in 2009, UNC Charlotte has certified construction and design on 71% of eligible construction based on occupied gross square feet. With smaller buildings that are not certified, the university continues to emphasize energy and water efficiency standards detailed in the Design and Construction Manual. Updates to the manual were

formally adopted in 2018-19 in areas of lighting, lighting controls, insulation, solar thermal heating systems, plumbing fixtures and construction/demolition waste diversion to align with ASHRAE 189.1 (2014) *Standard for the Design of High-Performance Buildings* and ASHRAE 90.1 (2016) *Energy Standard for Buildings*. Starting in 2020, the university has maintained a Gold-level membership in the US Green Building Council to make over 900 online courses available free to staff, faculty and students.

To gain an external comparison, UNC Charlotte participated in the USEPA Energy Star Higher Education Benchmarking Initiative. Energy data for the Main Campus for calendar year 2019 was submitted to EPA. A scorecard report was generated by EPA to compare UNC Charlotte to different institutional peer groups (from 187 participating campuses) in terms of energy use intensity (EUI). UNC Charlotte Main Campus EUI ranked: 60 out of 67 for campuses with central heating plants; 14 of 18 for campuses with 50-99 buildings; 21 of 25 for campuses with 7-12% Energy Intensive floor space; 18 of 20 for campuses in Climate Zone 3; 12 of 19 for campuses with 20-29% resident students; 20 of 24 for campuses with $90M-$700M endowments; and 3 of 4 for Carnegie classification Doctoral/Professional. In summary, UNC Charlotte's Main Campus EUI was higher than the median in every comparison group the EPA could assemble. This report challenges us to consider whether university and state standards, goals, and investments for energy conservation are too modest.

Water Systems Management

Since 2003, water utilization (gallons per square foot of buildings) has been reduced by 54%. The large growth of facilities and population since 2003 has only resulted in consumption growth of 8%. However, water plus sewer combined costs per gallon since 2003 have increased by 186% and thus water plus sewer spending has grown by 210%. Although, the university strives to reduce water consumption in campus facilities 2021 may not be indicative of actual performance do to operation changes associated with COVID-19, with previous years showing water utilization at ca. -45% and total water consumption at ca. +25% compared to our 2003 baseline.

There are four (4) distinct water systems associated with the UNC Charlotte campus. Those systems are 1) Potable Water, 2) Reclaimed Water (in development), 3) Sanitary Sewer, and 4) Stormwater.

Charlotte Water started construction in 2021 on a new sanitary sewer collection main which runs through the middle of the University's Campus. The new 42" sanitary sewer pipe will parallel Toby Creek replacing some of the Campus' existing 24" sewer collector main. Charlotte Water is also installing a 16" Reclaimed Water transmission line parallel to the new sanitary sewer.

UNC Charlotte has finished design of the Reclaimed Water infrastructure system and sent the plans out for bid. Construction is anticipated to be completed by the end of 2022. This infrastructure will connect to Charlotte Water's 16" transmission line. The reclaimed water will replace approximately 20% of the potable water currently used on campus, at a greatly reduced price per gallon. The Reclaimed Water will be used for cooling tower make-up water and irrigation water. The reclaimed water will be supplied from Charlotte Water's Mallard Creek Water Reclamation Facility near the Campus.

Energy Plan

UNC Charlotte's energy plan is structured into five 5 areas in order to accomplish specific goals in each of the categories below.

Energy Data Management – UNC Charlotte has a program for collecting and analyzing monthly utility billing information using spreadsheets. The main campus electrical substation is trended real-time to document high consumption periods. UNC Charlotte is beginning to compare energy usage in similar building types by usage, i.e. library, classroom building, research building, etc.

Energy Supply Management – UNC Charlotte is proactive in selection of electrical rates and cost-effective fuel rates for Regional Utility Plants. Energy supply management must also demonstrate choices that achieve the campus and UNC System goals to be carbon neutral by 2050, the state goal of 40% reduction in greenhouse gas emissions by 2025, and the City of Charlotte's Strategic Energy Plan for reducing greenhouse gas emissions per capita by 80% by 2050. Facilities Management thoroughly reviews utility invoices for deviations indicating billing errors.

Energy Use in Facilities – Building HVAC and lighting controls are updated as renovations occur or as Retro-Commissioning takes place. New buildings have state-of-the-art Building Automation System (BAS) controls. New and existing building control systems will be evaluated and adjusted for optimum energy usage.

Equipment Efficiency – UNC Charlotte requires all equipment replacements to meet or exceed code requirements. Preventive Maintenance is in effect. Major energy consuming equipment will be identified and evaluated for cost-effective modification or replacement. All chillers were selected on Life Cycle Cost Analysis.

The Utility Carry Forward funds have historically been used for Retro-Cx of campus buildings and fixing small equipment issues found by the Retro-Cx to improve the building energy efficiency. Larger and more capital intense equipment is normally funded through R&R capital projects. In FY-22, the Utility Carry Forwards funds are expected to fund ASHRAE Level II Energy Audits on campus and fixing energy issues found by these audits.

Organization Integration & Awareness Training – The Energy Manager will continue to work closely with the University Sustainability Officer for various energy conservation measures and training efforts within the appropriate University departments. The Sustainability Office priorities as of 2018 are to pursue compliance with the UNC Sustainability Policy (600.6.1). Energy management is recognized in the sustainability plan as under a category of "Operational Priority" with an expectation for continuous improvement. The Energy Manager will also contribute to a 5-year initiative on "Responsible Purchasing" that includes improving policies and practices regarding procurement of energy and technologies. In response to Sustainability being apart of the Chancellors strategic plan the Chancellor's Executive Sustainability Committee is drafting a Sustainable Facilities Policy that may include building standards, temperature policy, and purchasing of energy and water consuming equipment. These efforts are aimed at improving behavior and awareness in ways that contribute to the University's continued ability to exceed the state of North Carolina mandated conservation goals.

Past Year Accomplishments	Measurement	Savings Estimated	Cost	Funding Source	Area
Maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Monitored all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM Budget	Energy Data Management
Continued firm & interruptible transportation of nat. gas w/ well head pricing for RUP's.	$ per month	$234k	N/A	FM Budget	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM Budget	Energy Supply Management
Reviewed Duke Energy GreenSource Advantage PPA offering to determine renewable energy procurement enabled by HB589	kWh	N/A	N/A	FM Budget	Energy Supply Management
ASHRAE Level II Energy Audits conducted by FM in conjunction with university faculty at five (5) university buildings. Savings noted is identified.	kWh, Therms	$170k	$47k	Utility Carry Forward	Energy Use in Facilities
Implemented five (5) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$116k	$114k	Utility Carry Forward / FM	Energy Use in Facilities
Replaced 4 ultralow freezers in Dept. of Biol. Sci.	kWh	$1.25k	$40,700	Student green fund	Organization Integration & Awareness Training
Stormwater Master Plan	Final Report	N/A	$300k	FM Budget	Organization Integration & Awareness Training

Planned Activities 2021-2022	Measurement	Savings Estimated	Cost	Funding Source	Area
Continue maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Continue to monitor all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM	Energy Data Management
Continue firm & interruptible transportation of nat. gas w/ well head pricing for RUP's.	$ per month	$234k	N/A	FM	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM	Energy Supply Management
ASHRAE Level II Energy Audits will be conducted by FM in conjunction with university faculty at ten (10) university buildings.	kWh, Therms	TBD	$47k	Utility Carry Forward	Energy Use in Facilities
Implement ten (10) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$96k	$104k	Utility Carry Forward / FM	Energy Use in Facilities
Develop/Implement HW/CHW optimization Strategy	Develop/ Implement in 15 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
Implement Economizer Control, Supply Air Temp, & Demand Based Reset Strategies	Implement in 15 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
McEniry Hall Chiller Replacement	kWh	TBD	TBD	FM	Equipment Efficiency
Student Health Center AHU Replacement	kWh, Therms	TBD	TBD	Health Services	Equipment Efficiency
Develop Energy Efficiency Goals for BAS technicians & Train to Identify	kWh, Therms	TBD	TBD	FM	Organization Integration & Awareness Training
Develop a UNCC FM Energy Management web page.	Web Page Developed	N/A	N/A	FM	Organization Integration & Awareness Training
Finalize New Temperature Control Policy and implement with Administrative Facilities	Implement	TBD	TBD	FM	Organization Integration & Awareness Training
Grants to depts for upgrade costs for 6 EnergyStar ultralow freezers for new Science Building	kWh	$18,000	$12,000	Student green fund	Organization Integration & Awareness Training
Reclaimed Water System Water Quality Instrumentation (includes academic access to data)	Sensors purchased	N/A	$35,000	Student green fund	Organization Integration & Awareness Training
Transportation Plan Development (includes parking facility design standards)	Plan adopted	N/A	N/A	Sustainability Budget	Organization Integration & Awareness Training
Re-launch of Green Office Program to expand/update energy conservation tips	Office units certified	N/A	$3,000	Sustainability Budget	Organization Integration & Awareness Training
University Policy for Sustainable Facilities (includes energy and water conservation)	Submission to Chancellor	N/A	N/A	Sustainability Budget	Organization Integration & Awareness Training

Appendices

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